HEALTH ASPECTS OF PESTICIDES

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U.S. ENVIRONMENTAL PROTECTION AGENCY

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PESTICIDE PROGRAMS

TECHNICAL SERVICES DIVISION
Rm. E-315, 401 M Street, S.W.
Washington, D.C. 20460

HEALTH ASPECTS OF PESTICIDES ABSTRACT BULLETIN is a monthly publication of the Technical Services Division of the Environmental Protection Agency.

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides on humans. The publication represents a monthly review of more than 1150 domestic and foreign journals. Subjects and authors of abstracted articles are cross-referenced in an annual index issue. Reprint requests should be directed to the author of the complete article.

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73-2283. Springer-Verlag (New York, NY). **New journal announcement.** *Arch. Environ. Contam. Toxicol. 1(1): i; 1973.*

The *Archives of Environmental Contamination and Toxicology* is intended as a unified repository of important full-length articles in English describing original experimental or theoretical research work pertaining to the scientific aspects of contaminants in the environment. Published annually as one volume of four issues, it will deal with aspects of environmental contaminants including chemical analysis and air, water, and soil chemistry. Manuscripts will be reviewed by workers in the field and editorially revised to ensure unified format, style, and depth of detail. Review articles or shorter communications which fall outside the specifications of the *Archives* may be referred to *Residue Reviews* or *Bulletin of Environmental Contamination and Toxicology*. Relevant articles from the *Archives* will be abstracted in *Health Aspects of Pesticides.*

73-2284. Laird, M. (Res. Unit Vector Pathol., Memorial Univ. Newfoundland, St. John's, Newfoundland, Canada). **DDT yet again.** *BioScience 23(6): 337; 1973.*

A Letter-to-the-Editor describes the very selective application of DDT to tsetse fly resting sites in Africa and its success in controlling sleeping sickness of man and nagana disease of other mammals without apparently disrupting wildlife. DDT, which is essential to some integrated control programs, should not have been banned by the Environmental Protection Agency's director until better and economically competitive products were available. The adverse publicity created by this ban in Africa and other countries has made the job of the public health official more difficult.

73-2285. Hashimoto, Y. (Author address not given). **[Agricultural Chemicals Regulation Law, English translation; principal amended points.]** *Bull. Agr. Chem. Insp. Sta. 12: 129-142; 1972.*

The amended version of the Agricultural Chemicals Regulation Law, developed by the Ministry of Agriculture and Forestry of the Japanese government, includes a new statement of purpose. In addition to evidence relating to efficacy, phytotoxicity, acute mammalian toxicity, and fish toxicity, data on chronic (subacute) mammalian toxicity and residual properties must be included in applications for registration. Three additional instances have been added in which the registration process may be suspended pending correction of information or quality improvement: instances in which the chemical contaminates the soil with persistent residues, damages aquatic life, or pollutes water in the public sector. The Ministry of Agriculture and Forestry is also now empowered to rescind or suspend a pesticide registration or to restrict or prohibit the sale of registered agricultural chemicals if their use would result in excessive contamination of crops, man, domestic animals, or the environment. In a new system for controlling the use of agricultural chemicals, chemicals must be labeled with instructions for use, and penalties are provided for use in violation of label instructions. The English translation provided of the amended law is an unofficial one.

73-2286. Anonymous. **[Kind-, common-, trade-, and chemical names for pesticides appearing in the present issue, No. 12.]** *Bull. Agr. Chem. Insp. Sta. 12: 144-150; 1972.* (Japanese)

In the present issue pesticides were given officially established generic names which are, as a rule, suggested by the manufacturer of the pesticide. After some consideration the name is adopted or amended and officially recognized by the Ministry of Agriculture and Forestry. In some cases, when the pesticide is imported, the generic name coincides with the so-called English or American common name. However, when it is developed in Japan, the generic name is unique and sometimes has no connection to the trade name which is used when it is exported. The generic name is written in Japanese which makes it incomprehensible to foreigners. Therefore, although the table in this article is quite useful for Japanese, it is of almost no use to those who cannot read Japanese characters.

73-2287. Walker, J. O. (Agr. Div., BASF United Kingdom Ltd., St. Francis Tower, Greyfriars, Ipswich, Suffolk, IP1 1LE, England). **Agrochemicals.** *Chem. Brit. 9(5): 224-227; 1973.* (6 references)

The properties of a number of important chemicals currently in use in agriculture were discovered in the 1940s. Of the organochlorines, the cyclodiene insecticides have a higher mammalian toxicity than DDT and BHC and are generally extremely persistent. Mammalian toxicity of the organophosphates varies widely, but these compounds are less persistent than the organochlorines. Phenoxyacetic acids have low mammalian toxicity and residues do not persist to affect subsequent crops. Resistance and destruction of nontarget organisms have become a problem with the widespread use of agrochemicals, particularly insecticides. Research on newer, less toxic and less environmentally hazardous pesticides has become increasingly more expensive, with the result that development is not usually pursued unless the pesticide is assured of widescale use on a major world crop; only very large companies can afford the investment. Although criticism of the industry has helped to raise the risk evaluation to the present high standards, uninformed emotionalism may retard future development. The voluntary system of regulation used in England has worked well and has provided a flexible and realistic approach to risk appraisal.

73-2288. Mollenhauer, H. P. (Author address not given). **Chemikalien und Biozide in der Umwelt. [Chemicals and biocides in the environment.]** *Chem. Rundsch. 26(14): 29; 1973.* (German)

General problems of environmental chemicals and pesticides are discussed. A comprehensive approach to the study of all contaminants and pollutants in air, water, and food and their effects on human health is necessary. Although maximum allowable concentrations of pesticides in different media have been established in toxicological tests, the synergism of pesticides with other environmental chemicals has been explored inadequately. Moreover, systematic monitoring of environmental chemicals and pesticides in different media and segments of the environment will be necessary.

73-2289. Anonymous. **Pest control advisers face strict requirements in California.** *Citrus Veg. Mag. 36(9): 21; 1973.*

Pest control advisers will face progressively stricter requirements in the future. Certification in California through examinations is in progress, and the California Agricultural Pest Control Advisory Committee has a 4-step plan for upgrading and professionalizing pest control advisers. A gradual increase in educational requirements will be introduced which will lead to the requirement of a bachelor's degree in agriculture, biology, or pest management, or equivalent experience in 1980. Applicants having extensive education have been scoring higher on the examinations than those with 20 or 30 years experience in the field. More and more background will be needed in pest management as integrated methods of control are introduced.

73-2290. Krenkel, P. A. (Dept. Environ. Water Resources Eng., Vanderbilt Univ., Nashville, TN). **Mercury: environmental considerations. Part I.** *Crit. Rev. Environ. Contr. 3(3): 303-373; 1973.* (399 references)

Exaggerated and sometimes false claims of mercury poisoning, along with actual incidents of accidental poisoning, have led to the establishment of FDA tolerances, which may not be realistic, and caused serious economic losses in the fishing industry. A review of factors affecting the potential hazard presented by mercury and the regulation of this toxic element indicates the need for more research in all areas of the mercury problem. A small part of the mercury introduced into the environment is in the form of fungicides, slimicides, mildew proofing, and seed dressings. It is questionable whether the total output by man is significant when the natural occurrence of mercury is considered. A recent decline in human mercury levels has been noted, but information on normal human values is scarce. Analysis of a sample for total mercury involves preliminary treatment to release the mercury from the sample, usually wet oxidation, concentration of the mercury, and measurement.

73-2291. Dewey, J. E.; Pendleton, R. F.; McDonald, S. A., eds. (Dept. Entomol., Cornell Univ., Ithaca, NY). **Eighth Northeast Aerial Applicators Conference.** *Eighth Northeast Aerial Applicators Conference, J. E. Dewey et al. eds., Washington, 1972, 155p.*

Panel discussions and presentations from industry, government, and professional associations were presented at the Eighth Northeast Aerial Applicators Conference, held March 21-23, 1972, at Cornell University, Ithaca, NY. The conference was a regional project of the Northeastern Pesticide Co-ordinators in cooperation with the Extension Service of the U.S. Department of Agriculture. Efficient, economic, and environmentally safe application techniques were discussed and their implementation strongly recommended before legislation requires them or bans aerial application entirely. Federal legislation now being considered has had a great amount of input from all persons concerned and is, with a few exceptions, reasonable and workable and will not drastically affect present state regulations. Guidelines from the Environmental Protection Agency will be published as they are formulated.

73-2292. Higbee, F. F. (Nat. Agr. Aviation Ass., Loveland, CO). **Federal legislation and current regulations.** *IN: Eighth Northeast Aerial Applicators Conference. J. E. Dewey et al. eds., Washington, 1972, pp. 1-5.*

The Federal Environmental Pesticide Act (HR 10729) now being considered by the Senate has had a great deal of input from all segments of agriculture and is very acceptable. The National Agricultural Aviation Association has recommended that the classification of pesticides be limited to two categories–general use and restricted–and supports the indemnity provision which indemnifies anyone who holds a pesticide at the time it is suspended from sales. A change in the wording of the guarantee of registration is considered necessary in order to prevent the aerial applicator from being put into the position of guarantor. The Association is also working to have the states administer the bill because of the numerous specific uses of insecticides in different states.

73-2293. Frommer, C. H. (N.Y. State Dept. Environ. Conserv., Albany, NY). **What the federal regulations will mean to the states.** *IN: Eighth Northeast Aerial Applicators Conference. J. E. Dewey et al. eds., Washington, 1972, pp. 6-11.*

Federal pesticide regulations now being considered (HR 10729) will probably affect those state regulations regarding classification of pesticides since lists of restricted chemicals will have to reflect federal recommendations. Certification of applicators, based on training and examination, will be carried out by federally approved state programs which must be in effect within four years. An amendment that has been recommended would allow the states to register products on a local level for local problems.

73-2294. Dewey, J. E. (Dept. Entomol., Cornell Univ., Ithaca, NY). **Discussion of legislation–state and federal.** *IN: Eighth Northeast Aerial Applicators Conference. J. E. Dewey et al. eds., Washington, 1972, pp. 12-16.*

It would be almost impossible to design legislation to meet the needs of every area; the Federal Pesticide Law being considered will probably present some minimum standards on which the different states can elaborate. The matter of who is to be certified has not yet been resolved, but the decision on this question will govern the number and types of manuals to be put out by the Northeast Pesticide Coordinators. Since pressure is mounting for a total ban on some pesticides, the Northeast Aerial Applicators should take the initiative in improving application practices and in setting up guidelines to ward off such drastic action. States which have already enacted legislation concerning aerial application include Connecticut, where aerial application is limited to agricultural situations, and Maryland, where licensing of applicators is required.

73-2295. Turner, S. W. (Stuart W. Turner & Co., Seattle, WA). **Tort and product liability trends affecting agricultural aviation.** *IN: Eighth Northeast Aerial Applicators Conference. J. E. Dewey et al. eds., Washington, 1972, pp. 22-41.*

The basic principles concerning the causes of action under which a party alleging a product harmful may recover are limited to negligence, express warranty, or implied warranty. A review of cases of product (pesticide) liability indicates that decisions based on these principles can vary from state to state and from lower to higher courts. To protect himself the spray applicator should handle the chemical part of an application (if he is also selling the chemical) through a separate corporation as a separate contract. The position of the applicator and crop owner in regard to alleged injury to bees has been successfully defended on numerous occasions since under common law such entities are not required to keep their property safe from trespassing animals.

73-2296. Akesson, N. B.; Yates, W. E.; Wilce, S. (Agr. Eng. Dept., Univ. of California, Davis, CA). **Review on current techniques and prospects for increasing the confinement of chemical applications to treated fields.** *IN: Eighth Northeast Aerial Applicators Conference. J. E. Dewey et al. eds., Washington, 1972, pp. 96-105.*

The responsibility for application of agricultural chemicals with minimum drift begins with the chemical salesman, who must think in terms of safe application as well as control efficiency. The farmer and commercial applicator must share the burden of decision for chemical safety, a difficult task when a crop is jeopardized by pests. Further licensing and other qualification regulations, along with specific application control, will probably be introduced at all levels of chemical use. Research now indicates that better application techniques can be developed which would result in 100% confinement of materials to the target fields. In general, particles (liquid or solid) of under 50 μ do not settle out under normal atmospheric conditions; the rate of settling increases as the size of the particle increases. The use of large particles or attracting particles to plant surfaces with electrostatic charges, combined with use of properly engineered application equipment, may be instrumental in achieving low drift. The helicopter equipped with a Microfoil boom has been used successfully and competes with ground and fixed wing aircraft equipment.

73-2297. Biskind, M. S. (Westport, CT). **DDT scare.** *Environment 15(5): 29-31; 1973.* (15 references)

In a review of some of the historical aspects of the use of DDT entitled "Spoiled by Success" it was stated that allegations made in 1949 connecting DDT poisoning with X disease in cattle and virus X in man were later shown to be untrue. No references were included to support this conclusion. It was assumed in a Letter-to-the-Editor that a statement by federal agencies discounting the charges was used as the basis for it. The claim in the statement that outbreaks of the disease had been noted before the use of DDT do not negate the evidence connecting the two since other chlorinated hydrocarbons in use before DDT have induced the disease. In reply the editor notes that no studies provide sound evidence implicating DDT in X disease (hyperkeratosis).

73-2298. The Swedish Institute. (Hamngatan 27, P. O. Box 7072, S-103 82 Stockholm 7, Sweden). **Environmental protection in Sweden.** *Fact Sheets on Sweden. Stockholm, 1972, 4p.* (5 references)

Sweden faces the same environmental pollution problems, including those connected with the use of pesticides, which confront densely populated countries. High levels of mercury were found in several species of birds in the 1960s; since the use of mercury seed dressings and mercury in industry was restricted, levels have dropped, and bird populations seem to be increasing. Various animal species have contained high DDT and polychlorinated biphenyl residues; cod liver from the Baltic has been declared unfit for human consumtion because of the DDT content. DDT has been banned except for controlled use in tree planting, and amitrole has been taken off the market for use as an herbicide. Pesticides may not be sprayed from aircraft over forests or other nonarable land. The *Pesticide Ordinance* is administered by the Poisons and Pesticides Board; sales of pesticides are limited to officially registered chemicals and restrictions can be put on their use. Measures proposed to deal with the costs of preventing environmental degradation seek to transfer the costs to production and consumption.

73-2299. Anonymous. **Pesticides and the environment. The position of FAO.** *Food and Agriculture Organization, Rome, 1972, 11p.* (1 reference)

FAO considers that the policy of assisting, rather than denying, the controlled application of useful agricultural chemicals should be continued; however, the collection and assessment of information and precautionary measures need more work. Specific or otherwise valuable products or methods of application may have to be restricted or eliminated because of unacceptable contamination of the environment, but likely gains and losses will have to be evaluated carefully. Integrated methods of pest control are advocated by FAO where possible. Research in this field and in the monitoring of pesticide residues in the environment should be extended as far as funds permit.

73-2300. Kutyrin, I. M. (USSR Ministry of Water Management, Moscow, USSR). **O pestitsidakh. [On pesticides.]** *Gidrotekh. Melior. 25(4): 85-86; 1973.* (Russian)

Comments are presented on the value and the hazards involved in the use of pesticides in the USSR and other countries. Compliance with application rate standards and regulations on the transport and use of pesticides helps minimize environmental hazards of pesticide use. A ban has been imposed on the use of aldrin, dieldrin, endrin, DDT, chlordane, and mercaptophos (demeton). The use of DDT, BHC, and polychloropinene within 500 m of rivers and other water bodies has been prohibited as has aerial spraying within such zones to prevent pesticides from getting into reservoir water.

73-2301. Anonymous. **UK faces new pesticide laws in Europe.** *Int. Pest Contr. 15(1): 10; 1973.*

Now that Britain and Denmark, which have voluntary approval schemes for pesticides, have entered the European Economic Community, they will be faced with standardized registration formalities developed for European products. The Benelux countries are preparing a common pesticide act which will be the first step toward such standardization. Many points of safety are now agreed upon on a multinational basis without legislation. The EEC produced its first directive by setting maximum amounts of pesticide residues on and in fruits and vegetables and on raw cereals. Some problems for British growers are anticipated if certain directives are put into effect.

73-2302. Anonymous. **Una parola piu serena sull'impiego dei pesticidi in agricoltura. [A disquieting discussion on the use of pesticides in agriculture.]** *Ital. Vinic. Agr. 63(1): 30; 1973.* (Italian)

At the convention of the Society for Plant Protection held recently at San Remo on "The Contribution of Modern Plant Protection to the Resolution of the Problems of Hunger and Pollution," objections were raised to the accusation that agriculture since 1950 has indiscriminately disseminated dangerous and polluting pesticides in the environment. These accusations were countered with the argument that dangerous and polluting pesticides are few in number and are permitted to be used only under clearly specified conditions. The use of DDT makes it possible to prevent crop losses which could endanger the food supply, especially in developing countries. However, DDT residues persist in the environment and in the biosphere with potentially harmful effects to human health. Similar conclusions were reached by experts of the FAO and WHO at a recent meeting. Of other products examined, organic mercurial fungicides used for seed grain dipping were largely exonerated. It was stressed that the mercury thus introduced into the environment forms only a very small part of the total mercury emitted into the environment. Nevertheless, in view of the cases of poisoning that have occurred, an attempt must be made to replace organic mercury compounds with less toxic substances.

73-2303. Metcalf, R. L. (Dept. of Entomol. and Environ. Studies Inst., Univ. of Illinois, Urbana-Champaign, IL 61801). **A century of DDT.** *J. Agr. Food Chem. 21(4): 511-519; 1973.* (76 references)

In the nearly 100 years that have elapsed since DDT was first synthesized, this substance has had an influence on human ecology perhaps unmatched by any other synthetic substance. Through its effectiveness in the conquest of malaria, typhus, and other insect-borne diseases it has played a decisive role in the population explosion. It has also become the classic example of an environmental micropollutant. Significant discoveries about the chemistry of DDT and its analogs are still being made. These have considerable theoretical interest in studies of the enigmatic mode of action of DDT and are of applied interest in control of resistant insects and in environmental quality control. (Author abstract reprinted by permission of the American Chemical Society)

73-2304. Alley, E. G. (Mississippi State Chem. Lab., State College, MS 39762). **The use of mirex in control of the imported fire ant.** *J. Environ. Qual. 2(1): 52-61; 1973.* (97 references)

The chemical, physical, and toxicological properties of mirex, the characteristics of the imported fire ant which it is used to control, and arguments regarding the continued use of mirex are reviewed. Arguments favoring continued use of mirex include the severity of the fire ant nuisance, including reported fatalities in hypersensitive persons; the relative safety of mirex compared to alternative pesticides; and the probable widespread use of mirex (dechlorane) as a fire retardant in polymers, thus representing a more significant source of environmental contamination than its use as an

insecticide. Arguments against use of mirex include reports of tumor induction and toxicity in nontarget organisms, long-term persistence of mirex in the environment, and the relatively minor economic threat represented by the fire ant. Treatment of individual ant mounds with mirex would represent an alternative to large-scale aerial bait application; however, the necessity for repeated treatment resulting from reinfestation might ultimately demand larger quantities of pesticide. The current control program, which aims to minimize the environmental impact of mirex use and in which treatment is limited to seriously infested areas, seems to represent the best choice. (From author abstract)

73-2305. Bradley, Jr., R. L. (Dept. Food Sci., Univ. Wisconsin, Madison, WI 53706). **Polychlorinated biphenyls in man's food—a review.** *J. Milk Food Technol. 36(3): 155-162; 1973.* (45 references)

Polychlorinated biphenyls (PCBs) resemble DDT in their wide distribution, persistence, concentration in the food chains, and lipophilic character. Total loss of PCBs to the environment during peak production was estimated at 25,000 tons/yr. Contamination of food has resulted from biological magnification, migration of PCBs from packaging and storing materials to food and feed, and leaks in heat exchangers used in processing feed or food. The most prevalent toxic effects in animals have been observed in reproduction. An experience in Japan has shown that the effects of PCBs in man are difficult to overcome. Initial symptoms observed were swelling of the eye lids with increased eye discharge and acne-type skin eruptions. Tetrachloroparadibenzofuran, a by-product in the European manufacturing process, has effects similar to PCBs but is more toxic. GC is most frequently used to determine PCBs. Those having higher chlorine content have longer retention times. Some evidence of metabolism in animals has been accumulated, and breakdown has been observed on exposure to ultraviolet light. Production by the sole U.S. producer has been voluntarily curtailed and reduced contamination of food has resulted.

73-2306. Ruivo, M. (Fishery Resources Div., Food and Agr. Org., Rome, Italy). **Marine Pollution and Sea Life.** *Fishing News (Books) Ltd., London and Surrey, England, 1972, 624 p.*

This volume contains edited contributions and summaries of discussions at the FAO Technical Conference on Marine Pollution and its Effects on Living Resources and Fishing, held in Rome, December 9-18, 1970. The section Marine Pollution in the World Today contains descriptions of pollution problems affecting specific regions of the world oceans. The section entitled Behavior and Fate of Pollutants in the Marine Environment presents theoretical, experimental, and empirical considerations on distribution and alteration of pollutants. Effects of Pollution on the Biology and Life Cycle of Marine Organisms reports experimental results on individual organisms as well as more general cross-species observations. Ecosystem modifications and effects on marine communities are discussed in another section. Technical Aspects of Minimizing Pollution and Countering its Effects as discussed include studies on waste treatment and pollutant removal procedures as well as technical aspects of monitoring systems. The section Effects of Pollutants on Quality of Marine Products and Effects on Fishing includes discussions of toxicity of marine organisms caused by pollutants and effects of chemical and microbiological pollutants on the fishing and shellfishing industries. The concluding section examines the scientific basis for international legislative control of marine pollution in the interests of marine resources and fisheries. Pertinent articles are abstracted in this issue of *Health Aspects of Pesticides.*

73-2307. Gen. Fish. Council for the Mediterranean and the Int. Commission for Sci. Exploration of the Mediterranean Sea Group of Experts on Marine Pollution. (Author address not given). **Review on the state of pollution in the Mediterranean Sea.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 28-32.* (35 references)

Since the Mediterranean waters have limited exchange with the open ocean, they do not rid themselves of pollutants quickly. In areas of high agricultural production large amounts of pesticides are distributed and spread into the open sea through wind transport from coastal agricultural areas. Organophosphorus and carbamate insecticides rather than chlorinated ones have increased. In some locations in the western Mediterranean the intensive use of agricultural pesticides has caused marine organism death at all levels. In the eastern part pesticide pollution is still a local problem. In areas such as the Nile delta, Israel, and Cyprus intensive agricultural pollution is compounded by run-off and wind transport, causing more problems which will extend over larger areas. As yet polychlorinated biphenyls are not a serious problem. It is suggested that the countries along the Mediterranean should cooperate among themselves to solve specific problems in this region.

73-2308. Parsons, T. R. (Environmental Res. Group, Fisheries Res. Board Canada, Nanaimo, B. C., Canada). **Pollution problems in the Strait of Georgia.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 72-77.* (16 references)

Pollution problems were studied in the Strait of Georgia, located on the coast of British Columbia between the mainland of Canada and Vancouver Island. Many of the problems resulted from the widespread use of pesticides agriculturally in British Columbia although the direct relationship is not known. Aerial spraying of forests with DDT contributes to the pollution. Pesticides are often directly applied to rivers entering the Strait

and marine inlets to control mosquitos in river valleys (DDT), Ambrosia beetles on log booms (BHC), and Teredo on docks (sodium arsenite). The results of studies of the effects of pesticides on marine life based on 48 and 96 hour mortalities, especially with young salmonids, indicated that the pesticides are safe. Efforts are being made to replace DDT with less harmful chemicals which are readily degradable and which do not accumulate. However, continued monitoring of the Strait and systematic collection of data are needed.

73-2309. Gilmour, A. J. (Fisheries and Wildlife Dept., Melbourne, Victoria, Australia). **Marine pollution in Australia: a review of the present situation regarding problems, research investigations and management techniques.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 91-100.* (63 references)

Little data is available on the extent to which pesticides and fertilizers and general land utilization techniques have affected the marine environment. A report of seven organochlorines in sixteen specimens (five birds, three fish, some molluscs of one species, and a whale) has been offered. Flood run-offs, particularly in the sugar areas, may contain enough pesticide to kill large numbers of fish. Mosquito spraying on or near water contributes to the problem. A build up of persistent pesticides may be occurring in the water on the landward side of the Great Barrier Reef, with a subsequent threat to the Reef System. Values of 10 and 25 mg/l. have been obtained for nitrate-nitrogen respectively in two wells in a citrus producing area. Legislation is inadequate to deal with full control of the marine environment. It is suggested that a state centralized environmental agency be established, composed of engineers, economists, and ecologists, which would be responsible for coordination of research and management in these matters.

73-2310. Anoymous. **Summary of discussion.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 190-194.*

Many more species should be included in pollution testing. Tests must consider the role of the food chain in concentrating toxicity of the pollutant, the ecological significance of the organism under testing, and precise data on the physico-chemical environment and conditions of the test. A larger program of sublethal testing is needed. Sensitivity to DDT, dieldrin, or endrin varies greatly between species. Marine polychaetous annelids may be important as a food chain link for entry of DDT into fish. Fish eggs and advanced yolk-sac larvae of fishes are particularly sensitive to insecticides. Larval development of molluscs was seriously affected by several pesticides. Differences in toxicity of pesticides to different species of fish are explained by specific differences in the enzymatic activities which catabolize such compounds.

73-2311. Keckes, S.; Miettinen, J. K. (Lab. Marine Radioactivity, Int. Atomic Energy Agency, Monaco). **Mercury as a marine pollutant.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 276-289.* (216 references)

The high volatility of mercury makes it ever present in the atmosphere. The normal content is 0.01-0.07 ppb in ground water, 0.08-0.12 ppm in lake and river water, 0.03 ppb in sea water, and 0.1-0.3 ppm in polluted surface water. The natural cycling of mercury is aided by the volatile nature of the metallic and methylated forms and by the ease with which mercuric chloride dissolves in aqueous media. Mercury can be transformed by microbes, plants, and animals. Fish accumulate mercury and can transfer it to higher trophic levels in the food chain. Mercury enters the body through absorption, ingestion, or inhalation. Tolerance of mercury by various species differs as do the toxicity levels. The general composition of the environment is also a factor in toxicity levels; i.e., the effect of mixed solutions of heavy metals is usually not only additive, but synergistic. Teratogenic effects include fetal death, malformations of the spinal cord, and abnormal tails from the exposure of pregnant mice to phenyl mercuric acetate. It is suggested that the genetic effect of mercury may apply to all organisms. An increased frequency of chromosome breaks occurred in human lymphocyte cultures from persons who had eaten fish with high methyl mercury content.

73-2312. Eriksson, E. (Meteorol. Inst., Univ. Stockholm, Stockholm, Sweden). **Global monitoring of atmospheric pollution and its possible relation to a global marine monitoring scheme.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 489-491.*

An atmospheric pollution monitoring system is being established by the World Meteorological Organization. The system will include baseline air pollution stations located in remote areas to detect pollutants which may affect climate on a global scale. Studies of precipitation chemistry at these stations may reveal trends in levels of specific pollutants, such as DDT and heavy metals. Coordination of atmospheric and oceanic monitoring is desirable since pollutants may transfer from one medium to another by various processes. DDT from terrestrial sources may be carried to the ocean via rivers or via absorption into sea water from air masses contaminated by volatilization. A reverse transport process may explain the surprisingly uniform distribution of DDT in soils of areas where it was never applied. Lipids synthesized by marine organisms, especially zooplankton, may form films on the ocean surfaces and concentrate lipophilic pollutants such as DDT. The lipids and dissolved compounds could then be carried into the atmosphere during the production of sea salt particles and portions precipitated with the sea salts over land areas. Some evidence exists to support this proposed

pathway. The establishment of coordinated monitoring systems could elucidate related processes.

73-2313. Gerner, D. L. (Univ. Wisconsin, Madison, WI). **Redistribution and concentration of mercury in the environment.** *Mining Eng. (New York) 25(6): 52-53; 1973.* (7 references)

In the last 20 years outbreaks of mercury poisoning due to industrial contamination of fish and consumption of mercury-dressed seed have aroused fears of mercury in the environment. Although liquid mercury is not poisonous, organic mercury used in agriculture or made from mercury wastes by aquatic organisms is highly toxic. Under natural conditions mercury is present in extremely small amounts and is widely dispersed. Presently, large amounts of mercury wastes are flowing into the air and water creating local increases in residues. Research is needed to monitor significant increases and determine meaningful levels and hazardous forms of mercurial pollution. Controls must be established to stop the discharge of harmful mercury wastes and toxic industrial and agricultural materials replaced by less toxic substances.

73-2314. Lakhani, K. H. (Natural Environ. Res. Council, The Nature Conservancy, London, England). **Use of "whole egg residues" in pesticide/eggshell studies.** *Nature (London) 242(5396): 340-341; 1973.* (3 references)

Further refutation to Hazeltine's criticisms of Blus et al.'s conclusions concerning DDE and eggshell thinning (see abstracts no. 72-0972 and 73-0346) is presented. Although Hazeltine states that whole egg residues are valueless in eggshell studies, based on his hypothesis that DDE residues are metabolized during incubation, he provides no data expressed on a whole egg (fresh weight) basis. No direct evidence is provided to show that DDE or other pesticides are degraded during incubation. Even if the hypothesis of DDE metabolism during incubation were accepted, in view of the eggshell thinning by withdrawal of calcium from the shell to the embryo during incubation, the use of whole egg residue data would provide a conservative test of the correlation between eggshell thickness and residue level.

73-2315. Anonymous. **Firing the ant.** *Nature(London) 242(5397): 364; 1973.*

A number of public hearings have been called by the Environmental Protection Agency to gather information pertinent to the use of mirex against the fire ant in the southeastern U.S. The ant has been treated with numerous pesticides through USDA programs because of its painful sting and the damage to agricultural machinery caused by its mounds. Mirex, often used, has persisted in the environment, collected in some animals and insects, and caused cancer in mice. However, it is not acutely toxic to man and does not appear to present a long term hazard although more chronic toxicity studies are needed. A scientific advisory committee which reviewed the pesticide after Allied Chemical Corporation appealed its cancellation gave a qualified approval of its use. Aerial spraying and use near water or heavily forested areas are not permitted.

73-2316. Anonymous. **Pesticides: too much concern.** *Nature (London) 243(5402): 52; 1973.*

According to a World Health Organization committee on insecticides, misinterpretation or improper extrapolation of scientific data has sometimes led to unjustified restrictions on the use of certain pesticides like DDT. Withdrawal of DDT from areas previously subject to malaria epidemics could result in a return of the disease. The committee recommended that more tests, including comprehensive metabolic studies, on the effects of DDT on man be carried out. Education of the public to the basic principles of toxicology would help to dispel the excessive concern over the hypothetical effects of pesticides. The committee also recommended the introduction of less toxic mercury seed dressings and eventual elimination of mercury pesticides.

73-2317. Anonymous. **Another pesticide in trouble.** *Nature (London) 243(5406): 316; 1973.*

The public hearing on the use of aldrin and dieldrin will open soon in Washington. It is expected to be essentially, as in the case of the DDT hearing, a debate over the distinction between the socially accepted level of risk and the safe level for man. All uses of the pesticides except mothproofing, termite control, and some tree nursery uses have been cancelled; Shell Chemical Company and the Department of Agriculture are objecting to these cancellations. Persistence and biomagnification are the primary problems associated with these organochlorines. Although lawyers for Shell intend to argue that no runoff should occur with the three inch burial of aldrin, the Environmental Protection Agency will reveal evidence of large residues in water, many aquatic species, and some birds, and dieldrin residues in human adipose tissues of 99.75% of the U.S. population. Carcinogenicity will be another point of debate, the major point of disagreement being the pertinency of animal data to man.

73-2318. Matsunaka, S.; McMillan, R. (Nat. Inst. of Agr. Sci., Konosu, Saitama, Japan). **Safety with herbicides.** *N. Z. J. Agr. 126(5): 23; 1973.*

Herbicides should be applied only as specified on the labels, and legal requirements should be followed. Care must be taken to avoid incompatible mixtures, excessive dosages, and constant application of the same chemical; alternatives to chemical control should be applied where feasible. Acute toxicities of many herbi-

cides, particularly the photosynthesis inhibitors, are quite low, but chronic toxicity has appeared in humans as damage to the liver, nervous system, and other organs as well as mutagenicity, teratogenicity, and carcinogenicity. Research in the area of chronic toxicity of herbicides must be expanded in order to ensure the safety of future agricultural chemicals.

73-2319. Safety Panel of Federal Working Group on Pest Management (Washington, DC). **Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers.** *Federal Working Group on Pest Management, Rockville, MD, 1972, 180p.*

In addition to the transcribed presentations, which are abstracted individually in this issue of *Health Aspects of Pesticides*, this volume contains explanatory material and recommendations relating to the Conference, mentioned in the title and held at the Center for Disease Control, Atlanta, Georgia, May 1-2, 1972. The conference was convened to survey the current status of significance, technology, regulations, and acceptance regarding protective clothing and safety equipment for protection against harmful effects of pesticides. Participants included pesticide toxicologists, agricultural and industrial pesticide users, regulatory authorities, accident investigators and safety supervisors, and pesticide and protective clothing manufacturing representatives. Recommendations of the safety panel and conference discussions and recommendations are also presented. Recommendations deal with investigation of barrier creams, development of guidelines for use of protective equipment, testing and standardization of safety equipment, studies on feasibility of providing washing facilities for pesticide workers, establishment of federal standards for pesticide storage and of a pesticide accident reporting system, and formation of local pesticide disaster teams.

73-2320. Wilson, C. (Occup. Safety Health Admin., Dept. of Labor, Washington, DC). **Occupational health and safety standards that apply to pesticide exposure situations where protective clothing and safety equipment are needed.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers. Washington, 1972, pp. 63-64.*

The Williams-Steiger Occupational Safety and Health Act of 1970 requires that every employer and employee comply with health and safety standards set by the Secretary of Labor. The Act established the Occupational Safety and Health Administration (OSHA) to ensure that standards are met and that records of work-related accidents are kept. It set up the National Institute of Occupational Safety and Health, a research facility, and provided small business administration assistance for purchasing equipment required for compliance. Purely agricultural operations are not eligible for loans, however, unless use of their raw products does not exceed half of their total requirement. In the initial standards package prepared for agriculture, only some of the existing nationally recognized standards were included, but new standards for protection of agricultural workers will be prepared.

73-2321. Shelton, J. R. (Bureau Motor Carrier Safety, Dept. of Transportation, Washington, DC). **Regulations governing hazardous chemicals in loading and transportation operations where protective clothing and safety equipment should be available.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers. Washington, 1972, pp. 65-82.*

Since the enactment of the Department of Transportation Act, the safety regulatory and enforcement functions concerning transportation of hazardous materials by motor carrier have been carried out by the Bureau of Motor Carrier Safety under the Federal Highway Administration in the ten-region operating system. Regional hazardous material specialists have been hired to investigate accidents, check shippers, and contact chemical and container manufacturers. Addresses of safety investigators have been published, along with parts of the act which pertain to transportation of poisons. The requirement of a new hazardous materials reporting procedure in the case of accidents has yielded more information on the causes of accidents and their effects. This information will provide a basis for new regulations concerning protective clothing for drivers and other areas not yet covered. The transportation of Class B poison pesticides (i.e. those having 48-hr oral LD50s $>$ 50 mg/kg) is up 25% in the past five years. The exposure rate to accidents and spills has gone up accordingly, but there has not yet been any catastrophic loss of life due to a pesticide spill in the U. S.

73-2322. Wyatt, G. L. (OSHA, Atlanta Regional Off., Atlanta, GA). **The concern of the federal government for the safety and protection of workers exposed to potentially hazardous situations.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers. Washington, 1972, pp. 113-116.*

Since the formation of the Occupational Safety and Health Administration (OSHA), the staff has grown to 1000 people, guidelines based on national consensus standards and federal standards already in existence were published, and work is proceeding on establishment of new standards in the field of pesticides. At present, only a few existing standards such as the one on air contaminants apply to pesticide use. There is disagreement about the effectiveness and zeal of OSHA, but the problem may be the Act itself.

73-2323. Harrington, J. F. (IRI Res. Inst. Inc., One Rockefeller Plaza, New York, NY 10020). **Herbicide Orange surplus.** *Science 180(4093): 1320; 1973.* (2 references)

The sale of surplus Herbicide Orange to Latin American countries is being encouraged by IRI Research Institute for reasons explained in a Letter-to-the-Editor. The Institute has been working for 20 years on the problem of brush control in pastures in Brazil and Venezuela and has found 2,4-D and 2,4-T, the basic ingredients in Herbicide Orange, to be effective, but costly. The possible hazard involved in using the chemicals in agriculture is much less than that involved in military applications since the application rate is about 27 times less. Warm, wet seasons during which the herbicide works most efficiently allow for accelerated biodegradation. The best results were obtained when animals were kept out of sprayed pastures for three or four months; fewer toxic materials should accumulate in the food chain. Very little human exposure is expected because little labor is required and the pastures are in rural areas. The proposed project includes an extensive educational program to ensure proper handling.

73-2324. Carter, L. J. (Author address not given). **Pesticides: environmentalists seek new victory in a frustrating war.** *Science 181(4095): 143, 145; 1973.*

A series of administrative hearings on the use of aldrin and dieldrin are about to begin. Testimony is expected to be even more lengthy and sophisticated than that heard in the DDT hearings. The Shell Chemical Company, the chief defender of the pesticides, has vast resources and will attempt to prove that dieldrin is not carcinogenic. Shell will also argue that it has already suspended the uses of aldrin and dieldrin which created environmental hazards. The case to be developed by the Environmental Protection Agency (EPA) and the Environmental Defense Fund (EDF) will center on the mobility of the pesticides in the environment, their toxicity to wildlife and threat to humans, and their incompatibility with modern concepts of integrated pest control. Data from Shell's own laboratory will be used by the EPA and EDF to argue that dieldrin is carcinogenic in mice. The case against aldrin and dieldrin is expected to be carefully built. Witnesses include specialists from the National Cancer Institute.

73-2325. Stoefen, D. (Author address not given). **Toleranzwerte fuer Schadstoffe im Trinkwasser. [Tolerance limits for pollutants in drinking water.]** *Staedtehygiene 24(5): 109-114; 1973.* (12 references) (German)

A list of standards currently valid in the USSR for 294 harmful and toxic substances, potential pollutants in drinking water, and comments and criticism of the present status of West German toxicology are presented. Russian standards have been established on the basis of thresholds of functional, neurological, and behavioral disturbances and promise a certain protection against functional and degenerative disorders. Leading toxicologists in Germany, having realized that the present situation is not satisfactory, urge intensification of fundamental research and elaboration of maximum allowable concentrations on the basis of carcinogenic, mutagenic, and teratogenic effects, for which no-effect doses do not exist. The elaboration of standards for drinking water without adoption of the Soviet values would probably take several decades.

73-2326. Festy, B. (Lab. d'Hygiene de la Ville de Paris, Paris, France). **Donnees actuelles sur les utilisations et la toxicity du mercure. [Current data on use and toxicity of mercury.]** *Tech. Sci. Munic. 68(4): 161-171; 1973.* (13 references) (French)

The use and toxicological and ecologic problems of mercury are surveyed. Mercury compounds present in water accumulate through food chains, starting from phytoplankton across fish to piscivorous birds. High concentrations of mercury can occur in the organism of granivorous birds due to ingestion of dressed seeds. The mercury concentrations in birds and fish range from 0.02 to 1.4 ppm, and values up to 200 ppm in the liver of birds and fish were measured. Neuropathy with multiple sensory disturbances, salivation, transpiration, ataxia, paralysis of peripheral nerves, and congenital cerebral palsy with mental retardation are among the common consequences of acute poisoning with mercury. Mercury, which accumulates mainly in the liver and brain, is eliminated from the organism slowly, primarily through the feces. Interaction of mercury with enzyme and membrane proteins and DNA, interference with cell division, induction of chromosome aberrations, and incorporation of mercury in the soluble fraction of the cytoplasm were observed.

73-2327. Elsevier/North Holland (Amsterdam, The Netherlands). **New journal announcement.** *Toxicology 1(1): 1; 1973.*

Toxicology is a new quarterly journal for the publication of original scientific papers dealing with biological effects on animal and human tissues ensuing from administration of chemical compounds. Compounds of interest include food additives, pesticides, drugs, animal feed additives, chemical pollutants, industrial chemicals, and residues resulting from the use of the preceding. Epidemiological studies with toxicologic significance for man also fall within the journal's scope. A section encompassing brief reports on toxicologic findings relating to the environment will be included. Subtitled "An international journal concerned with the effects of chemicals on living systems," *Toxicology* has an editorial board representing Europe, the United States, and Asia. An introductory editorial by the editor-in-chief explains the need for a journal devoted to the field of toxicology in view of the active

interest in toxicologic findings today and the tremendous increase in the number of new chemical substances to which man is exposed.

73-2328. Worden, A. N. (Huntingdon Res. Cent., Univ. College, Cambridge, England). **Toxicology and the environment.** *Toxicology 1(1): 3-27; 1973.* (89 references)

In the past decade a new awareness of the hazards of pesticides, drugs, and other chemicals introduced into the environment by man has developed, especially as a result of the publication of *Silent Spring* and the publicity given unfortunate incidents such as the induction of fetal malformations by thalidomide. Such focused attention will probably bring about an improvement in testing of future chemicals and will not be detrimental to the fields of pesticides, drugs etc., but it has done permanent damage to individual products, even when retractions have had to be made. Toxicologists should concentrate on improving testing methods, particularly those designed to determine the degree and rate of reversibility of changes induced by a given material and on problems which appear to present the greatest hazard rather than the greatest political or emotional attraction. New techniques, like the comparative assay of pesticide toxicity being developed on the basis of the dose-related induction of liver enzymes by DDT, will enhance but not replace existing animal methods. These will hopefully give a more realistic assessment of the potential hazards of pesticides than has been afforded to DDT, hexachlorobenzene, 2,4,5-T, and other pesticides.

73-2329. Ladonin, V. F.; Khachatryan, S. M.; Gal'per-Blichenko, Ye. M. (All-Union Sci. Res. Inst. Fertilizers, Agr., Soil Sci., USSR). **O vliyanii monurona i linurona na nekotoryye fiziologo-biokhimicheskiye protsessy v rasteniyakh. [The effects of monuron and linuron on some physiological and biochemical processes in plants.]** *Agrokhimiya 3: 103-112; 1973.* (22 references) (Russian)

Monuron's and linuron's effects on photosynthesis and metabolism as well as their residues were studied in bindweed, pea, corn, barley, and grape. Monuron and linuron considerably affected the metabolism of nucleic acids, proteins, and free amino acids, and inhibited photosynthesis. Linuron applied to pea plants at a concentration of 100 mg/l. did not leave residues. An increased concentration of 1000 mg/l. left a residue of 31.5 μg/g dry matter during the first 24 hours although the residue decreased to 15.8 μg/g in nine days. Application of linuron to corn in a 100 mg/l. solution left residues of 10 ppm or less in 1-9 days. Application of a 2000 mg/l.solution left residues of 109 ppm the first day after spraying, and 49 ppm on the ninth day. Application of linuron in 1000 mg/l. or 2000 mg/l. solution left residues in the 100-170 ppm range during the first six days.

73-2330. Forsyth, D. J.; Peterle, T. J. (Dept. Zool., Ohio State Univ., Columbus, OH 43210). **Accumulation of chlorine-36 ring-labeled DDT residues in various tissues of two species of shrew.** *Arch. Environ. Contam. Toxicol. 1(1): 1-17; 1973.* (35 references)

DDT residues in two species of shrew were studied in a 4.05 hectare old-field ecosystem treated in June 1969 with ^{36}Cl-ring-labeled DDT at a rate of 0.92 kg/hectare. Residues in *Blarina* were approximately the same in 1970 and 1971, were not influenced by sex, and averaged 10 ppm in liver, 10 ppm in muscle, 4 ppm in brain, and 135 ppm in fat. Seasonal variation was observed in both years, and peak residues coincided with peaks in slug populations. When *Blarina* from control areas were released into the treated area, DDT residues reached those of resident shrews within 15 to 20 days. The levels of DDT accumulated by *Sorex* were greater in 1971 than in 1970, suggesting that the pesticide was increasing in availability to *Sorex*. Lower levels of DDT were observed in muscle and viscera of males with scrotal testes and in lactating females.

73-2331. Ware, G. W.; Morgan, D. P.; Estesen, B. J.; Cahill, W. P.; Whitacre, D. M. (Dept. Entomol., Univ. Arizona, Tucson, AZ 85721). **Establishment of reentry intervals for organophosphate-treated cotton fields based on human data: 1. ethyl and methyl parathion.** *Arch. Environ. Contam. Toxicol. 1(1): 48-59; 1973.* (10 references)

Experiments were conducted in cotton fields immediately after aerial application of methyl parathion and toxaphene in August and of methyl and ethyl parathion (parathion) and toxaphene in September. Leaf residues of methyl and ethyl parathion were determined, and human exposure to the organophosphates was assessed. Leaf residue patterns obtained indicate that methyl parathion has a considerably shorter residual life than ethyl parathion, but methyl paraoxon accumulates approximately twice as fast as paraoxon. The workers' hands were the greatest source of absorbed chemical since these were deliberately brought in contact with the plants while very little material was found in the air. No plasma or red blood cell ChE depression or urinary excretion of *para*-nitrophenol were observed following a single 30-minute exposure on day 1. After two 30-minute exposures, at zero and four hours, parathion was present in serum.

73-2332. Westlake, W. E.; Gunther, F. A.; Carman, G. E. (Dept. Entomol., Univ. California Citrus Res. Cent., Riverside, CA 92502). **Worker environment research: dioxathion (Delnav) residues on and in orange fruits and leaves, in dislodgable particulate matter, and in the soil beneath sprayed trees.** *Arch. Environ. Contam. Toxicol. 1(1): 60-83; 1973.* (5 references)

Residues of dioxathion on Valencia orange leaves and in and on the orange rind dissipate at approximately the same rate, the half-lives being > 100 days in each case. Easily dislodged residues, which are hazardous to fruit pickers and other workers, accounted for approximately 60% and 45% of the total 4 days and 35 days after spraying, respectively. About 90% of the toxicant collected in air samples during violent mechanical shaking of the sprayed trees occurred in the form of particles above 7 μ in diameter that might enter nasal passages and be swallowed or absorbed, but would not enter the lung. During experiments in which workers wore air samplers and were monitored for dust deposited on skin, the maximum ratio for inhalation plus oral versus dermal absorption was 1:16. A significant portion of the residue was removed by washing the entire trees with a dilute detergent solution. The data obtained in this study provides a guide for the design of tests for evaluating hazards workers encounter in pesticide-treated citrus groves.

73-2333. Iwata, Y.; Westlake, W. E.; Gunther, F. A. (Dept. Entomol., Univ. California Citrus Res. Cent., Riverside, CA 92502). **Persistence of parathion in six California soils under laboratory conditions.** *Arch. Environ. Contam. Toxicol.:1(1) 84-96; 1973.* (17 references)

Two types of persistence curves were obtained for parathion residues in six California soils under laboratory conditions. In Mocho silt loam, Linne clay, Madera sandy loam, and Laveen loamy sand, residues decreased rapidly, from 20 ppm to 0.2-2 ppm in 30 days. Microbial degradation and hydrolysis were responsible for the rapid decline. Degradation by hydrolysis alone appeared

to occur in Windy loam and Santa Lucia silt loam in which residues remained above 1.5 ppm for 8 months. Flooding fortified samples of these two soils did not increase the rate of degradation while such treatment noticeably accelerated the decline of parathion residues in Madera sandy loam. Parathion disappeared more rapidly in soils with low organic matter, suggesting that binding to organic matter may reduce the availability of parathion for degradation.

73-2334. Kennedy, J. M.; Talbert, R. E. (Author address not given). **Activated charcoal as a herbicide antidote.** *Arkansas Farm Res. 22(2): 12; 1973.*

Increasing rates of application of activated charcoal from 0 to 500 lb/A generally decreased the activity of nitralin and fluometuron applied 23 hr prior to the antidote at rates of 1 and 1.5 lb/A, respectively. The indicator species were grain sorghum for nitralin and squash for fluometuron. When planting was carried out on the day of charcoal application, at least 500 lb/A was required to inactivate nitralin while only 125 lb/A was required to inactivate fluometuron. Lower rates of charcoal were more effective after several weeks. Soils treated only with charcoal showed inactivating properties for 12 wk but not 24 wk when fluometuron was added to soil samples.

73-2335. Kawahara, T.; Moku, M.; Nakamura, H. (Agr. Chem. Inspection Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[Studies on organochlorine pesticide residues in crops and soils. Report XIII. BHC in cow milk.]** *Bull. Agr. Chem. Insp. Sta. 12: 23-27; 1972.* (2 references) (Japanese)

BHC residues were studied in the feed, milk, and excreta of 40 cows from a university farm for one year. BHC was found in all feed specimens; its level in concentrated feed was about 10 times greater (0.056-0.567 ppm) than in roughage (0.001-0.077 ppm). In concentrated feed the level of β-isomer was high (0.014-0.328 ppm) and δ-isomer low (0.000-0.056 ppm). BHC was detected in all milk specimens, with β-isomer higher than γ- and δ-isomers. In summer β-isomer was lower in the milk because of the increased supply of roughage. Analyses on the same day showed a high correlation between levels in feed and milk, suggesting rapid excretion through the milk of BHC taken from the feed. The average amount of total daily excretion of BHC per cow was 930 μg corresponding to 40% of daily intake; 360μg was excreted in the milk, δ-isomer easily excreted and β-isomer with difficulty. Chlorobenzenes and chlorophenols which had been recognized as metabolites of BHC were not detected in the urine and the feces with gas chromatography.

73-2336. Kawahara, T. (Agr. Chem. Insp. Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[Studies on organochlorine pesticide residues in crops and soils Report XV. Absorption of BHC by stems and leaves of rice plants.]** *Bull. Agr. Chem. Insp. Sta. 12: 31-34; 1972.* (4 references) (Japanese)

Absorption and residues of α-, β-, γ-, and δ-BHC mixed uniformly with volcanic ash soil at levels of 0.05, 0.1, 0.05 and 2 ppm were studied in rice plants. Residues of each isomer were determined in the straw, root, and soil after harvesting. The amount of absorbed BHC was, on the whole, larger in the root than in the straw, the concentration of each isomer decreasing in the order $\alpha>\beta>\delta>\gamma$ in the root and $\beta>=\delta>\gamma$ in the straw. Increased concentration of an isomer in the soil caused increased concentration of residues in the whole plant except those of γ- and β-isomers in the straw. Other isomers in both parts of the plant plateaued. The residual amount of BHC at harvest was proportional to the added amount of BHC although γ-BHC disappeared faster than the other isomers when its concentration in the soil was high. The results of the present experiment supported the results of investigation in paddies.

73-2337. Kawahara, T.; Moku, M. (Agr. Chem. Insp. Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[Studies on organochlorine pesticide residues in crops and soils. Report XVI. Degradation and isomerization of BHC isomers by heating.]** *Bull. Agr. Chem. Insp. Sta. 12: 35-37; 1972.* (3 references) (Japanese)

As a followup to reports of BHC residues in commercial cigarettes and interconversions of isomers during smoking, a study was performed on the behavior of BHC isomers in cigarettes during heating. Studies were also carried out on individual purified isomers. When 5 g of a brand of cigarettes containing 0.745, 1.155, 0.865, and 0.815 μg respectively of α-, β-, γ-, and δ-BHC was ashed in an evaporating dish on an electric heater, the smoke evolved contained 0, 0.340, 0.505, and 0.307 μg of the respective isomers. The change in isomer ratio suggests decomposition and isomerization during heating. When 1 μ of each BHC isomer was heated individually, the α-isomer yielded 159, 148, and 41 ng of the β-, γ-, and δ-isomers, respectively, with 158 ng of unchanged α-isomer; the β-isomer gave 116, 152, and 43 ng of the α-, γ-, and δ-isomers with 317 ng of unchanged β-isomer; the γ-isomer gave 148, 136, and 22 ng of the α-, β-, and δ-isomers with 178 ng of unchanged γ-isomer; and the δ-isomer gave 112, 113, and 147 ng of the α-, β-, and γ-isomers with 110 ng of unchanged δ-isomer. As decomposition products, 1,2,3- and 1,2,4-trichlorbenzene were detected. Isomerization also occurred when isomers were heated in a silica tube to exclude the possible catalytic action of trace metals in the evaporating dishes.

73-2338. Kawahara, T.; Matsui, M.; Nakamura, H. (Agr. Chem. Insp. Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[Studies on the residual organochlorine residues**

in crops and soils. Report XVIII. BHC in soil of paddy field.] *Bull. Agr. Chem. Insp. Sta. 12: 42-45; 1972.* (8 references) (Japanese)

Contamination of the surface soil layer (0-20 cm) and the subsoil (deeper than 20 cm) by BHC was studied in paddy fields in three prefectures. On the whole, BHC persisted more in the surface soil layer (0.097, 0.430, 0.042, and 0.006 ppm of α, β, γ, and δ-isomer) than in subsoil (0.006, 0.032, 0.007, and 0.001 ppm). The amount of each isomer persisting in soils was in the order of $\beta > \alpha > \gamma > \delta$, both in the surface layer and in the subsoil, in spite of the larger quantity of α-isomer in technical BHC. Smaller applications resulted in less comtamination by the residue. β-BHC persisted in soil longer than δ-BHC, and BHC was more persistent in clay soil than in sandy soils.

73-2339. Kawahara, T. (Agr. Chem. Insp. Sta., Min. of Agr. and Forestry, Tokyo, Japan).**[Studies on the residual organochlorine pesticides in crops and soils. Report XIX. Disappearance of BHC on Petri-dish in laboratory room.]** *Bull. Agr. Chem. Insp. Sta. 12: 46-48; 1972.* (Japanese)

Disappearance of α-, β-, γ-, and δ-BHC was traced on a Petri dish in amounts similar to those in fields. Normal temperatures under diffused sunlight were used for about two months. Regardless of formulations (wettable powder, dust, EC.) the disappearance of γ-isomer was the fastest, the residue almost disappearing within 5 days; days required for 90% disappearance were 1.8 in EC, 3.3 in dust, and 4.5 in WP. Those for α-isomer were 2 in EC, 4 in WP, and about 23 in dust; complete disappearance occurred in 10, 20, and 28 days, respectively. The δ-isomer took 5.8, 17, and 19 days for 90% disappearance; dust and EC took 28 and 58 days for complete disappearance. β-isomer persisted longer than other isomers, taking 4.5, 29, and 32 days for 50% disappearance. The curves of residual amount versus time were similar to those for BHC applied on crops or in water, suggesting that evaporation and decomposition by sunlight are the main factors for disappearance.

73-2340. Kawahara, T. (Agr. Chem. Insp. Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[Studies on the residual organochlorine pesticides in crops and soils. Report XX. Disappearance of BHC isomers in water.]** *Bull. Agr. Chem. Insp. Sta. 12: 49-51; 1972.* (1 reference) (Japanese)

The disappearance over time of α, β, γ, and δ-BHC dissolved in tap water at concentrations of 0.01, 0.1, 1.0, and 5.0 ppm was studied. The samples were kept in an open wide-mouthed transparent glass bottle under natural sunlight. Tap-water was added every two days for 48 days. Alpha and β-BHC disappeared most quickly; α-BHC residues dropped to about 10% after 7 days and a minute amount persisted for 48 days; β-BHC residue dropped to 20-30% (less in more dilute solution) after 10 days. Gamma-BHC (lindane) followed a pattern similar to α-BHC except at a concentration of 5 ppm; after 48 days residues were only traces. No definite trend occurred with the disappearance of δ-BHC concerning concentration; at all concentrations it took the longest time to disappear. The half-lives under the above conditions were 4-6, 4.5-9, 5-11, and 10-20 days for α-, β, γ, and δ-BHC.

73-2341. Kawahara, T.; Nakamura, T. (Agr. Chem. Insp. Sta., Min. Agr. and Forestry, Tokyo, Japan). **[Studies on the residual organochlorine pesticides in crops and soils. Report XXI. Absorption and translocation of chlorinated hydrocarbons in potted turnips.]** *Bull. Agr. Chem. Insp. Sta. 12: 52-56; 1972.* (2 references) (Japanese)

The relationship between the chlorinated hydrocarbon contents of soil and uptake by turnips grown there was studied. Small turnips were planted in pots of soil containing α-, β-, γ-, and δ-BHC, endrin, dieldrin, heptachlor, and heptachlor epoxide at concentrations of 0.05, 0.1, 0.5, 1, 5, 10, and 50 ppm each. Chlorinated hydrocarbon contents were analyzed in roots and greens of turnips harvested 1.5 months later. The residues found were proportional to the initial concentration of chlorinated hydrocarbon in the soil, and the ratio of soil level to level in turnip root ranged from about 5:1 for dieldrin to 100:1 for heptachlor. Endrin, heptachlor epoxide, and BHC isomers had soil:plant residue ratios in the range of 20:1-10:1.

73-2342. Fujimoto, Y.; Kawahara, T.; Nakamura, H. (Agr. Chem. Insp. Sta., Min. Agr. and Forestry, Tokyo, Japan). **[Residue of an organoarsenic pesticide for controlling rice sheath blight in rice plants and soils in treated paddy fields.]** *Bull. Agr. Chem. Insp. Sta. 12: 71-75; 1972.* (4 references) (Japanese)

Organoarsenic fungicides such as ferric methanearsonate are indispensable for controlling rice sheath blight, one of the major diseases of rice plants in Japan. The relationship between the amount of organoarsenicals applied and their residues in rice grain, straw, and soil was studied. The residues of total, inorganic, and organic As (as As_2O_3) were determined in polished and unpolished rice grain, straw, and soil to which ferric methanearsonate had been applied at rates of 5.2-16 g (as As_2O_3)/10 are in four districts. Total amount of As in the soil was unexpectedly high in all districts even in the fields where no arsenic had been applied (rates of 13.5, 55.0, 20.0, and 57.50 ppm). About 54-100% of total As was inorganic, the organic As percentage being very small. In rice grain harvested in paddy fields where the soil contained more than 20 ppm of organic As, unpolished rice grain contained 0.68-1.65 ppm total As and 0.05-0.62 ppm organic As. Total As of less than 1.0 ppm and organic As of less than 0.3 ppm were detected in unpolished rice grain harvested in fields where total As was 60 ppm and organic As very small.

73-2343. Kawahara, T. (Agr. Chem. Insp. Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[Chlorinated hydrocarbon pesticide residues in feed.]** *Bull. Agr. Chem. Insp. Sta. 12: 100; 1972.* (Japanese)

As soon as BHC and polychlorocyclodienes were detected in milk, concern over their routes of contamination in milk occurred. Several kinds of cow feed were selected and analyzed for polychlorohydrocarbon pesticide residues by methods suitable for each feed. The results of analysis of α-, β-, γ- and δ-BHC, dieldrin, heptachlor, aldrin, endrin, and DDT are presented. As a rule, BHC remained in large amounts in concentrated feeds such as rice bran. Values were 0.085, 0.180, 0.023, and 0.015 ppm of α-, β-, γ-, and δ-BHC, and traces of DDT. Pesticide contents were lower in roughage such as dentcorn: 0.008, 0.008, 0.003, 0.001 ppm of α-, β-, γ- and δ-BHC, 0.011 ppm of *p,p'*-DDT, and 0.001 ppm of dieldrin. DDT was detected in all the specimens collected and dieldrin in a limited number of specimens. Heptachlor, aldrin, and endrin were not detected in all the specimens.

73-2344. Kawahara, T. (Agr. Chem. Insp. Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[Chlorinated hydrocarbon pesticide residues in the rice straw, paddy soil and Italian rye grass soil.]** *Bull. Agr. Chem. Insp. Sta. 12: 101-102; 1972.* (Japanese)

Chlorinated hydrocarbon pesticide residues were studied in the soil of paddy fields, in rice straw, and in the soil of Italian rye grass fields. The rice straw was divided into parts of equal weight, upper and lower. The residues determined were tabulated in ppm. Heptachlor epoxide was not detected in rice straw except in one sample with 0.004 ppm; 0-0.05 ppm aldrin, 0.004-0.132 ppm *p,p'*-DDE, 0-0.464 ppm of *o,p'*-DDT, and 0.016-0.66 ppm of *p,p'*-DDT were detected, the last two compounds being greater in the upper part and aldrin in the lower part. In paddy field soil (upper soil layer to the depth of 20 cm) 0-0.003 ppm heptachlor epoxide, 0-0.070 ppm aldrin, 0-0.054 ppm endrin, 0-0.030 ppm *p,p'*-DDE, 0-0.13 ppm *p,p'*-DDD (TDE), 0-0.105 ppm *o,p'*-DDT, and 0-0.40 ppm of *p,p'*-DDT were detected. In Italian rye grass fields dieldrin and aldrin were not detected, and only a small amount of DDT-derivative was detected. The amount of these residues should decrease gradually due to the ban of their usage.

73-2345. Watanabe, T.; Nakamura, H. (Agr. Chem. Insp. Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[Lead absorbed by eggplant from soil and its translocation.]** *Bull. Agr. Chem. Insp. Sta. 12: 105-106; 1972.* (2 references) (Japanese)

Absorption of lead as lead arsenate from soil by greenhouse eggplants (Wagner pots) was investigated. Approximately constant amounts of lead were found in the fruits at harvest, regardless of the rate of lead arsenate application; i.e., residue levels of 0.21, 0.35, 27-0.35, and 0.33 ppm at application rates of 0, 75, 375, and 750 mg/pot respectively. The lead content of the fruits was lower than that in the other plant parts. The lead content in other plant parts was more nearly proportional to the application rate. The lead residues found in this study were similar to those previously found in field-grown eggplants and slightly higher than the residues in cucumbers.

73-2346. Watanabe, T.; Nakamura, H. (Agr. Chem. Insp. Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[Lead residues in vegetables and fruits on the market.]** *Bull. Agr. Chem. Insp. Sta. 12: 107-108; 1972.* (4 references) (Japanese)

Following three reports, lead residues detected in vegetables and fruits on the market from April 1971 to March 1972 were published. The target crops were cucumber, turnip, apple (Ralls Janet and American Summer Pearmain), eggplant, spinach, Japanese radish, green pepper, and tomato. Contents in cucumbers were 0-3.33 ppm, 0.05-0.12 ppm in turnip leaves and 0.16 in roots, 0.09-0.49 ppm in apples, 0.07-0.44 ppm in eggplant, 0.02-0.20 ppm in spinach, 0-0.12 ppm in Japanese radish, 0.08 ppm in green pepper, and 0 ppm in tomato. Some differences were seen in the same species when production place differed. The above figures were less than the standard residue content (tolerance) of 5.0 ppm in/on apple and spinach and 1.0 ppm in/on cucumber and tomato.

73-2347. Greichus, Y. A.; Greichus, A.; Emerick, R. J. (Exp. Sta. Biochem., S. Dakota State Univ., Brookings, SD 57006). **Insecticides, polychlorinated biphenyls and mercury in wild cormorants, pelicans, their eggs, food and environment.** *Bull. Environ. Contam. Toxicol. 9(6): 321-328; 1973.* (26 references)

Pelicans from the Lake Poinsett ecosystem in S. Dakota had levels of 0.25 ppm heptachlor epoxide, 0.26 ppm lindane, 1.38 ppm dieldrin, 107.84 ppm DDE, 2.11 ppm TDE, 2.16 ppm DDT, and 22.4 ppm polychlorinated biphenyls in their fat. Eggs, brain, liver, and remaining body parts contained lower amounts of these chlorinated hydrocarbons. The ratio of residues found in pelicans was similar, but levels were somewhat higher. Organochlorine residues in bottom sediments were about 7 times greater than those in the water, and in fish which served as food for the birds concentrations were about 10-60 times greater than those in bottom sediments. PCBs were concentrated in the fish an average of 12-fold over bottom sediments, in which levels were generally higher than those of organochlorines. Levels of insecticides in birds were 250-to-280-fold greater than those in fish. Levels of PCBs were concentrated in cormorant 60-fold over fish and in pelicans only 30-fold. Differences in wintering grounds could be responsible for the difference in PCBs and also in a difference observed in mercury levels since mercury was not found in water, bottom sediments, or most of the fish.

73-2348. Wilson, D. M.; Oloffs, P. C. (Pestology Cent., Dept. Biol. Sci., Simon Fraser Univ., Burnaby 2, B. C., Canada). **Residues in alfalfa following soil treatment with high purity chlordane (Velsicol HCS-3260).** *Bull. Environ. Contam. Toxicol. 9(6): 337-344; 1973.* (13 references)

Chlordane residues in initial growth of alfalfa two months after treatment with Velsicol HCS-3260 at 5 and 10 lb/acre averaged 0.12 and 0.34 ppm, respectively. Alfalfa was cut at three months, and residues found at four months and one year were markedly reduced. Concentrations of α- and γ-chlordane in the soil did not decline over the same period. Oxychlordane, believed to be formed only in animals, comprised from 9 to 17% of the total residue in alfalfa and small quantities of 1,2-dichlorochlordene were also detected. Photo-*cis*-chlordane made up 9 to 16% of the residues in the plant and was also found in the soil. Confirmation of the identity of oxychlordane was made using four different GLC columns, chemical derivatization, *p*-value determination, and column chromatography.

73-2349. Giam, C. S.; Wong, M. K.; Hanks, A. R.; Sackett, W. M.; Richardson, R. L. (Texas A&M Univ., College Station, TX 77843). **Chlorinated hydrocarbons in plankton from the Gulf of Mexico and northern Caribbean.** *Bull. Environ. Contam. Toxicol. 9(6): 376-382; 1973.* (15 references)

DDT and PCB (polychlorinated biphenyl) residues were found in plankton collected from a number of stations in the Gulf of Mexico and the northern Caribbean. Levels of DDT ranged from traces to 34μg/kg wet weight and those of PCBs ranged from < 3 to 1055μg/kg. The highest PCB residues were found in coastal areas, but no geographic trend could be determined for PCBs or DDT. Caution must be used in interpreting the results since species composition and differences in extraneous material collected may drastically affect the levels of chlorinated hydrocarbons found.

73-2350. Sovljanski, R. (Inst. Agr. Res., Novi Sad, Yugoslavia). **Degree and rate of degradation of some pesticides under intensive chemical control for sugar beet protection.** *Bull. Sci. Cons. Acad. Sci. Arts RSF Yougoslavie Sect. A 18(1-3): 23-24; 1973.*

Results of a three year study of the degradation rates of pesticides used on sugar beets indicate that the root may be used as fodder several days after one or two treatments with DDT while the leaves should not be used for this purpose until six weeks after treatment. Other efficient, but less persistent insecticides should be substituted for DDT to maintain a tolerance limit level of insecticide on the foliage. The residues of heptachlor found were completely harmless, and the use of this insecticide has been satisfactory. Trichlorfon on the foliage was degraded to the tolerance limit within 10 days and had almost completely disappeared in 15 days. The roots of plants treated with trichlorfon were fit for fodder immediately. Thiometon residues were below tolerance limits at all harvesting dates and hence treated plants could be fed even to dairy cows.

73-2351. Lyons, E. T.; Salman, H. A. (Applied Sci. Branch, Div. Gen. Res., Eng. Res. Cent., Denver, CO 80225). **Development of analytical procedures for determining chlorinated hydrocarbon residues in waters and sediments from storage reservoirs.** *Bureau of Reclamation, Rept. No. REC-ERC-72-15, 1972, 6p.* (17 references)

Water samples from Lake Mead on the Colorado River contained from 0.2 to 5.00 ppb lindane; kelthane (dicofol), TDE, DDE, DDT, heptachlor, heptachlor epoxide, aldrin, dieldrin, perthane, endrin, and methoxychlor were not detected in these samples. None of the insecticides were found in bottom sediments, but interferences in the samples made analysis extremely difficult. The method developed for this study was based on electron capture GC of hexane extracts of water samples and diethyl ether-petroleum ether soxhlet extracts of sediments cleaned up on a Florisil column. Percent recoveries ranged from 91 to 104% for DDE, dieldrin, TDE, lindane, heptachlor, and heptachlor epoxide while 80% of the aldrin was recovered.

73-2352. Percival, H. F. (Clemson Univ., Clemson, SC). **Concentration of selected chlorinated hydrocarbons in bobwhite quail and natural quail foods with notes of effects on reproduction.** *Diss. Abstr. Int. 33(11): 5508B; 1973.*

Brain, fat, breast muscle, liver, kidney, and gonads from bobwhite quail collected at eight locations in the coastal plains of South Carolina were analyzed for residues of mirex, *p,p'*-DDT, *p,p'*-DDD (TDE), and *p,p'*-DDE. Mirex was found in birds from only two of the areas, and concentrations were highest in fat. Highest concentrations of total DDT were found in fat and liver of birds from agricultural areas. Legumes, cultivated crops, and mast of oak and sweetgum were the most significant winter food items of the quail. No adverse effects on reproductive capacity of pen-reared bobwhite quail were observed after feeding of 10 ppm DDT in the diet through two breeding seasons. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-11014.)

73-2353. Hornsby, A. G. (Oklahoma State Univ., Stillwater, OK). **The movement and description of fluometuron in Norge loam soil.** *Diss. Abstr. Int. 33(12) Part 1: 5618B; 1973.*

Pore-water velocity, adsorption, desorption, and aggregate size influenced the movement of fluometuron in Norge loam soil. Faster pore-water velocities pre-

vented establishment of equilibrium adsorption between the herbicide and the soil in the column. Adsorption took place rapidly when batch adsorption techniques were used. Aggregate size affected the effluent concentration distributions because of changes in the available soil particle surface for reaction and pore-water flow properties. Two existing mathematical models tested using the data did not accurately predict the concentration distributions obtained. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-15 44.)

73-2354. Hyzak, D. L. (Colorado State Univ., Fort Collins, CO). **The rate of degradation of metribuzin and two analogs in soil.** *Diss. Abstr. Int. 33(12) Part 1: 5619B; 1973.*

Rates of degradation of metribuzin, BAY-88410 (4-amino-6-isopropyl-3-(methylthio) -*as*-triazin-5(4H)-one and BAY-86791 (4-amino-6-cyclohexyl-3-(methylthio)-*as*-triazin-5(4H)-one, applied at 10 ppm in sandy loam soil in the laboratory, were highly temperature dependent. At 5 and 20° metribuzin degraded more slowly than its analogs. At 35° all three degraded at similar rates, and the limit of detection (0.01 ppm) was reached in 9-10 months. The calculated half-lives for the three compounds at 5, 20, and 35° averaged 329, 44, and 16 days, respectively. The pattern of herbicide degradation in the field followed that observed in the laboratory. It is expected that laboratory data can be extrapolated to the field. (Author abstract by permission. Copies of the thesis are available from University Microfilms, Order No. 73-13038.)

73-2355. David, B. A. (Cornell Univ., Ithaca, NY). **Decline of insecticidal activity in plants treated with aldicarb, carbofuran and phorate.** *Diss. Abstr. Int. 33(12) Part 1: 5889B-5890B; 1973.*

The changes in activity of three systemically absorbed insecticides were followed in plants growing in treated soil and in plants separated from the source after toxicant uptake. In plants in which the roots were transferred to untreated soil after insecticide uptake, half-lives ranged from 7 days for aldicarb in lettuce at 70°F and 11 days for carbofuran in lettuce at 70°F to 67 days for carbofuran in broad bean at 85°F and 70 days for aldicarb in potato at 85°F. In general, phorate persisted longer than aldicarb or carbofuran. The shortest half-life for phorate was 20 days in potatoes, whereas the half-life of phorate was 75 days in broad bean at 85°F. The relationship of half-life to crop and temperature was highly variable, and no trends could be detected. A leafhopper bioassay system was used to assess insecticide concentrations in the plants. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-14700.)

73-2356. Mackay, D.; Wolkoff, A. W. (Dept. of Chem. Eng. and Appl. Chem. and the Inst. of Environ. Sci. and Engineering, Univ. of Toronto, Toronto, Ontario, Canada). **Rate of evaporation of low-solubility contaminants from water bodies to atmosphere.** *Environ. Sci. Technol. 7(7): 611-614; 1973.* (17 references)

Equations are derived to predict the rate of evaporation from aqueous solutions of compounds such as hydrocarbons and chlorinated hydrocarbons which are of low solubility. The rate of evaporation can be high even for compounds of low vapor pressure, and "half lives" in solution can be as low as minutes or hours under laboratory or environmental conditions. The rate may be limited by diffusion or desorption. Transfer of contaminants from the water to air environments may thus occur much faster than has been generally appreciated. (Author abstract reprinted by permission of the American Chemical Society).

73-2357. Ahr, W. M. (Dept. Geol., Texas A & M Univ., College Station, TX 77843). **Long-lived pollutants in sediments from the Laguna Atascosa National Wildlife Refuge, Texas.** *Geol. Soc. Amer. Bull. 84(8): 2511-2515; 1973.* (11 references)

Sediment cores taken from five locations in the Laguna Atascosa National Wildlife Refuge were of three types with respect to DDT distribution. Sample 1, taken where runoff water enters the area, showed a rapid decrease in DDT from 16 to 1 ppb with depth. Sediment here was very fine and monotonous with few crab burrows. Samples 2 and 3, taken further into the area, contained 2-8 ppb DDT evenly distributed down to 110 cm; sediment was extensively burrowed and mixed. Fine layers of sediment in the middle to lower regions were accompanied by increases in DDT residues in the cores taken close to Laguna Madre. DDT was concentrated exponentially as the higher ecological levels of the area were analyzed. Although lead arsenate insecticides were used extensively before the introduction of DDT in land surrounding the refuge, lead and arsenic were not concentrated in the sediments.

73-2358. Kirchhoff, J. (Author address not given). **Verhalten von Pestizidrueckstaenden bei der Verarbeitung von Lebensmitteln. [Behavior of pesticide residues during the processing of foods.]** *Hohenheimer Arbeiten, Schriftenreihe der Universitaet Hohenheim, Allgemeine Reihe No. 61: 21-28; 1972.* (German)

The effects of various processing and preparation methods of food products on pesticide residues are reviewed. The loss of pesticide residues during processing may vary widely from total elimination to zero elimination depending on processing, storage, food product, and pesticide involved. Lindane is eliminated from flour during milling; malathion, dimethoate, and bromophos metabolize to more toxic and then harmless compounds during wheat storage. Organochlorine pesticides are

quantitatively eliminated from potatoes by washing and peeling while cooking has little effect on the residue level. Deep-freezing and steam cleaning have little effect on pesticide contents in fruits although storage at room temperature and washing with water and peeling are usually effective. Diazinon and parathion residues persist in carrots. Residue elimination is more complete in industrial canning processes than in household preservation techniques. Carbaryl and some organophosphorus pesticides were transferred from grapes into wine. Roasting and cooking under pressure are more effective in eliminating organochlorine pesticide residues from beef than normal cooking although ordinary cooking is sufficient for removing such residues from poultry. Most of the organochlorine residue content in fish is present in liver oil. Organochlorine residues in milk are transferred into fatty fractions during processing to cream, ice-cream, butter, and cheese.

73-2359. Abdel-Gawad, H. A.; Martin, G. C. (Dept. Botany, Univ. California, Davis, CA 95616). **The fate of 1,2-^{14}C-(2-chloroethyl)phosphonic acid (ethephon) in peach.** *HortScience 8(2): 125-126; 1973.* (14 references)

Branches of a tree containing one peach per branch and having the bark stripped at the base of the branch were sprayed in May with 5-ppm unlabeled ethephon. Each fruit surface and the lower surface of a leaf basipetal to the fruit was treated with ^{14}C-ethephon. After 40 days 23.6% of the radioactivity applied to the leaves and fruit was recovered from the total fruit, 16.7% being on the surface. The amount recovered from the surface at 95 days was approximately the same, but the amount extracted from the fruit had decreased to 1.06%. Unidentified metabolites were observed in the extracts of fruits at 40 and 95 days.

73-2360. Newsom, H. C.; Woods, W. G. (U. S. Borax Res. Corp., Anaheim, CA 92801). **Photolysis of the herbicide dinitramine (N^3, N^3-diethyl-2,4-dinitro-6-trifluoromethyl-*m*-phenylenediamine).** *J. Agr. Food Chem. 21(4): 598-601; 1973.* (10 references)

The photolysis of the herbicide dinitramine (N^3, N^3-diethyl-2,4-dinitro-6-trifluoromethyl-*m*-phenylenediamine) in methanol and in water was investigated. The compound degraded rapidly through reductive cyclization of a nitro group and an adjacent *N*-ethyl group to give the following products: 6-amino-1-ethyl-2-methyl-7-nitro-5-trifluoromethylbenzimidazole; 5-amino-1,2-dihydroxy-3-ethyl-2-methyl-4-nitro-6-trifluoromethylbenzimidazoline; 1-ethyl-6-hydroxylamino-2-methyl-7-nitro-5-trifluoromethylbenzimidazole; and 6-amino-2-methyl-7-nitro-5-trifluoromethylbenzimidazole. (Author abstract reprinted by permission of the American Chemical Society).

73-2361. Sethunathan, N. (Central Rice Res. Inst., Cuttack-6, Orissa, India). **Degradation of parathion in flooded acid soils.** *J. Agr. Food Chem. 21(4): 602-604; 1973.* (9 references)

The persistence of parathion (*O,O*-diethyl *O*-(*p*-nitrophenyl) phosphorothioate) in five acid soils under flooded conditions was investigated. The insecticide degraded faster in soils which had a higher organic matter content. Fastest degradation occurred in an acid sulfate soil with an organic matter content of 12.2%, apparently due to microbial participation. Repeated additions of parathion to an alluvial soil enhanced its hydrolysis to *p*-nitrophenol. Heat treatment of the parathion-hydrolyzing enriched culture from the alluvial soil retarded its activity, indicating the role of biological agents in the hydrolysis. A *Bacillus* sp. capable of readily decomposing *p*-nitrophenol as a sole carbon source was isolated from parathion-amended flooded alluvial soil. (Author abstract reprinted by permission of the American Chemical Society)

73-2362. Woodham, D. W.; Reeves, R. G.; Edwards, R. R. (U. S. Dept. of Agr., Animals and Plant Health Insp. Serv., Environ. Qual. Lab., Brownsville, TX 79408). **Total toxic aldicarb residues in weeds, grasses, and wildlife from Texas high plains following a soil treatment with insecticide.** *J. Agr. Food Chem. 21(4): 604-607; 1973.* (2 references)

Aldicarb residues in weeds, grasses, and wildlife following a soil application of the granular insecticide in dryland and irrigated fields were investigated by a gas chromatographic-flame photometric detector (gc-fpd) analysis. Residues of aldicarb and/or its metabolites (as the sulfone) were detected in 80% of the grass and weeds collected from treated areas and in 83% of samples from untreated sections of these fields. No detectable residues were found in samples from adjacent untreated, noncultivated areas outside the treated fields. In irrigated fields residues were detected in approximately 73% of samples from treated areas, 38% of samples from untreated sections of treated fields, and 31% of samples from adjacent untreated, noncultivated areas outside the treated fields. Residues in grasses and weeds gradually decreased with time and with plant growth, which created a dilution factor. Residues were detected in only one of the wildlife samples collected in and around the treated fields. This was an oriole showing 0.07 ppm of aldicarb and/or metabolites. (Author abstract reprinted by permission of the American Chemical Society)

73-2363. Bache, C. A.; Gutenmann, W. H.; St. John, L. E.; Sweet, R. D.; Hatfield, H.; Lish, D. J.* (Pesticide Residue Lab., Dept. of Vegetable Crops, Cornell Univ., Ithaca, NY 14850). **Mercury and methylmercury content of agricultural crops grown on soils treated with various mercury compounds.** *J. Agr. Food Chem. 21(4): 607-613; 1973.* (7 references)

Beans, cabbage, carrots, millet, onions, potatoes, and tomatoes were grown on silt loam, gravelly loam,

and muck soils treated with 1 and 10 ppm of mercuric chloride, methylmercury dicyandiamide (PAN), or phenylmercuric acetate. Appreciable concentrations of methylmercury were present only in PAN-treated soils and in beans, millet, and tomatoes grown on those soils. Total mercury was usually less than 0.1 ppm in the edible plant portions, with the highest concentrations occurring most generally when growth occurred on the gravelly loam treated with PAN. Onion bulbs absorbed up to 1.1 ppm of total mercury. The highest concentrations of total mercury in plant stems and leaves were attained in potatoes and tomatoes. (Author abstract reprinted by permission of the American Chemical Society)

73-2364. White, E. R.; Bose, E. A.; Ogawa, J. M.; Manji, B. T.; Kilgore, W. W. (Dept. of Environ. Toxicol., Univ. of California, Davis, CA 95616). **Thermal and base-catalyzed hydrolysis products of the systemic fungicide benomyl.** *J. Agr. Food Chem. 21(4): 616-618; 1973.* (7 references)

The chemical fate of benomyl fungicide in practical use situations was investigated and is described in the present paper. Conversion products were isolated, purified, and subsequently subjected to a number of spectroscopic techniques appropriate for structural characterization. Synthesis routes for obtaining otherwise unavailable reference standards of hydrolysis products are described and a degradative pathway of benomyl to these conversion products is proposed. (Author abstract reprinted by permission of the American Chemical Society).

73-2365. Smith, A. E. (Canada Dept. Agr., Regina Res. Sta., Regina, Saskatchewan, Canada). **Transformation of dicamba in Regina heavy clay.** *J. Agr. Food Chem. 21(4): 708-710; 1973.* (10 references)

The degradation of [^{14}C]dicamba, labeled in the carboxyl group, was studied in moist nonsterile Regina heavy clay at 25 ± 1°. Following soil extraction with 0.1 *M* calcium chloride solution, gas chromatographic and radiochemical analytical procedures were used to monitor the breakdown at weekly intervals. Loss was rapid, with approximately 10% of the applied dicamba being recovered after five weeks. Further treatment of the calcium chloride-extracted soils with 1 *N* sodium hydroxide solution recovered small amounts of dicamba (less than 10% of those applied) and increasing quantities of a product identified as 3,6-dichlorosalicylic acid. At the end of five weeks, approximately 28% of the dicamba had been transformed into the demethylated compound. Radioactive carbon dioxide was also liberated from the treated soils, indicating that dicamba or the 3,6-dichlorosalicylic acid, or both, underwent decarboxylation. (Author abstract reprinted by permission of the American Chemical Society)

73-2366. Pionke, H. B.; Chesters, G. (Agr. Res. Serv., Soil and Water Conservation Res. Div., U. S. Dept. of Agr., Chickasha, OK). **Pesticide-sediment-water interactions.** *J. Environ. Qual. 2(1): 29-45; 1973.* (150 references)

Pesticide-sediment-water interactions occurring within a watershed and the associated aquatic system are reviewed regarding their impact on the distribution and persistence of pesticides in recipient lakes. Pesticidal persistence on the watershed is discussed initially because the aquatic residue hazard depends largely on the persistence of soil-applied pesticides. Mechanisms of transport from field to aquatic system are reviewed for those compounds not degraded rapidly to nontoxic derivatives. Pesticide transport through the atmosphere, ground water, and surface runoff is traced with particular emphasis on application-associated losses and transport effect on initial pesticide distribution and concentration in the aquatic system. Field and plot studies evaluating pesticide losses in runoff are summarized. Within the aquatic system, limnological, sediment, and water characteristics potentially alter the distribution of adsorbed pesticide between water and associated sediment within the lake. Specifically, the effects of pH, lake stratification, characteristics and content of sediment organic matter and clay, and salinity are evaluated. This review concludes with a discussion of literature on pesticide persistence determined in simulated or natural aquatic systems and the interactions between aquatic vegetation, sediment, and water which affect pesticide distribution. (Author abstract by permission)

73-2367. Hubbell, D. H.; Rothwell, D. F.; Wheeler, W. B.; Tappan, W. B.; Rhoads, F. M. (Dept. of Soils, Univ. of Florida, Gainesville, FL 32601). **Microbiological effects and persistence of some pesticide combinations in soil.** *J. Environ. Qual. 2(1): 96-99; 1973.* (8 references)

Zineb, parathion, DDT, and Furadan (carbofuran) were applied alone and in combination to field plots, with times and rates of application approximating current agronomic practice for the growth of shadeleaf tobacco in the area of Quincy, Florida. Persistence of the pesticides in the soil and possible effects of the pesticides on relative microbial numbers and nitrification were monitored at 2-week intervals over a period of 16 weeks. Relative numbers of bacteria and actinomycetes in all treatments failed to differ significantly from the untreated control. Fungi increased significantly (5% level) in the parathion + DDT + zineb treatment. There were no other significant differences in microbial numbers. Nitrification, as indicated by levels of NO_3-N, showed no significant difference due to treatments when compared to the control at the 5% level. Parathion applied as a single dose was present in the soil in significantly higher amounts initially when compared with treatments where parathion was applied on a weekly basis. This difference disappeared after six weeks. There

were no other significant differences in pesticide persistence in the soil. (Author abstract by permission)

73-2368. Farmer, W. J.; Igue, K.; Spencer, W. F. (Dept. of Soil Sci., Univ. of California, Riverside, CA 92502). **Effect of bulk density on the diffusion and volatilization of dieldrin from soil.** *J. Environ. Qual. 2(1): 107-109; 1973.* (4 references)

The rate of volatilization of dieldrin from a buried soil layer generally increased as the bulk density of an overlying soil layer decreased. The rate of diffusion through soil and, therefore, the rate of volatilization is controlled by the bulk density of the soil. The rate of volatilization of dieldrin from a buried soil layer increased with time, reaching a maximum level when diffusion through the overlying soil layer neared a steady state. The volatility rate was proportional to the initial dieldrin concentration in the buried soil layer. The volatilization of dieldrin from treated soil is concluded to be controlled by a diffusion process once the surface soil pesticide concentration is reduced. (Author abstract by permission)

73-2369. Wheeler, W. B.; Rothwell, D. F.; Hubbell, D. H. (Dept. of Soil Sci. and Dept. of Food Sci., Univ. of Florida, Gainesville, FL 32601). **Persistence and microbiological effects of acarol and chlorobenzilate in two Florida soils.** *J. Environ. Qual. 2(1): 115-118; 1973.* (7 references)

The influence of the miticides Acarol (bromopropylate) (benzilic acid, 4,4′-dibromo-isopropyl ester) and chlorobenzilate (benzilic acid, 4,4′-dichloro-ethyl ester) on nitrification capacity and relative microbial numbers in Lakeland and Leon fine sands was determined. Since chlorobenzilate is now used commercially and a proposal is pending for the registration and sale of Acarol, it is important to assess the effects of these materials on soil microbial populations. The miticides were applied to Lakeland and Leon fine sands at rates of 0, 0.25, 0.50, and 1.0 ppm, incubated in the laboratory for 16 weeks, and sampled for analysis at periodic intervals. Neither chemical influenced the nitrification capacity of either soil or the numbers of fungi, bacteria, and actinomycetes. Acarol was more persistent than chlorobenzilate; both chemicals remained at higher levels for longer periods of time in Leon soil than in Lakeland soil. The miticides had finite rates of disappearance from both soils. (Author abstract by permission)

73-2370. Lavy, T. L.; Roeth, F. W.; Fenster, C. R. (Dept. of Agron., Univ. of Nebraska, Scotts Bluff Sta., Mitchell, NB). **Degradation of 2,4-D and atrazine at three soil depths in the field.** *J. Environ. Qual. 2(1): 132-137; 1973.* (19 references)

Soil from three depths was treated with 2,4-D and atrazine and buried in the soil profile for 5, 17, 29, and 41 months at two locations in Nebraska. Degradation of 2,4-D stored in field pits at 15-, 40-, and 90-cm depths was rapid under aerobic soil conditions at both locations. Rates of atrazine degradation decreased with increasing soil depths. In Sharpsburg silty clay loam phytotoxic amounts of atrazine dissipated during the first 5 months at the 15-cm depth, and during the first 17 months at the 40-cm depth. Atrazine treated samples buried at 90 cm in the same profile contained phytotoxic amounts of atrazine after 41 months as shown by a soybean bioassay and gas chromatographic analysis. (Author abstract by permission)

73-2371. Gilmour, J. T.; Miller, M. S. (Dept. of Agron., Univ. of Arkansas, Fayetteville, AR 73701). **Fate of a mercuric-mercurous chloride fungicide added to turfgrass.** *J. Environ. Qual. 2(1): 145-148; 1973.* (15 references)

The behavior of a mercurous-mercuric chloride fungicide (Calomel) added to turfgrass and bare soil was investigated. From 44 to 56% of the total Hg added to a turfgrass surface was lost in 57 days. Plant uptake and removal upon cutting did not account for these losses which were attributed to volatilization of metallic Hg formed in the turfgrass-soil system. Where additions were made in the turfgrass root zone, loss was reduced and redistribution of Hg in the soil followed a pattern in qualitative agreement with metallic Hg formation and redistribution. Verification of volatilization from bare soil surfaces was made. (Author abstract by permission)

73-2372. Helling, C. S.; Isensee, A. R.; Woolson, E. A.; Ensor, P. D. J.; Jones, G. E.; Plimmer, J. R.; Kearney, P. C. (Agr. Environ. Qual. Inst., Agr. Res. Serv., U. S. Dept. of Agr., Beltsville, MD 20705). **Chlorodioxins in pesticides, soils, and plants.** *J. Environ. Qual. 2(2): 171-178; 1973.* (39 references)

Chlorodioxins, such as 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD), are highly toxic impurities found in certain pesticides. A review is made of the sources and toxicology of TCDD and its relationship to the herbicide 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) and pesticide analyses and soil-related environmental studies of TCDD conducted by the U.S. Department of Agriculture. TCDD was persistent and immobile in soils. The dioxin was not detected, however, six years after abnormally high applications of 2,4,5-T to Lakeland sand. TCDD was not photodegraded on soil and only slightly in aqueous suspension. Plants grown in soil containing 0.06 ppm TCDD had no detectable quantity ($\leq$1 ppb) at maturity. It was not translocated when applied to leaves, but washoff or volatilization occurred. TCDD was undetected ($<$50 ppb) in 19 bald eagle (*Haliaeetus leucocephalus*) carcasses. (Author abstract by permission)

73-2373. Walker, W. W.; Stojanovic, B. J. (Gulf Coast Res. Lab., Ocean Springs, MS). **Microbial versus chemical**

degradation of malathion in soil. *J. Environ. Qual. 2(2): 229-232; 1973.* (15 references)

Chemical and microbiological degradation of malathion was studied in three Mississippi soils (Trinity loam, Freestone sandy loam, and Okolona clay) and their aqueous dilutions. Malathion abatement in all cases was more rapid under non-sterile than under sterile conditions, indicating the involvement of the soil microflora in malathion dissipation. Malathion disappearance under sterile conditions was interpreted as chemical degradation. The amount of microbial as compared to chemical degradation seemed to increase with increasing soil organic matter and was directly dependent on soil pH. Microbiological degradation predominated in all three test soils and their aqueous dilutions. The greatest amount of chemical degradation occurred in Okolona clay. Malathion was quite stable under neutral or acid pH conditons, but was susceptible to hydrolysis in the alkaline pH range. (Author abstract by permission)

73-2374. Nash, R. G.; Harris, W. G. (Agr. Environ. Qual. Inst., Agr. Res. Cent., U. S. Dept. of Agr., Beltsville, MD 20705). **Chlorinated hydrocarbon insecticide residues in crops and soil.** *J. Environ. Qual. 2(2): 269-273; 1973.* (19 references)

A series of small Congaree sandy loam field plots at Beltsville, Maryland, were treated with 0, 56 or 112, and 224 kg/ha of aldrin, dieldrin, isodrin, endrin, heptachlor, chlordane, BHC, toxaphene, or Dilan in 1951. Sixteen years later the parent compounds were still detectable with mean total residues of 29 (pure aldrin), 35 (technical aldrin), 23, 16, 39, 10, 9, 7, 49, and 15% respectively, remaining. Aldrin, isodrin, and heptachlor had oxidized primarily to their epoxide. Soybeans (*Glycine max* L., Merr.), corn (*Zea mays* L.), oats (*Avena sativa* L.), and wheat (*Triticum aestivum* L.) were grown consecutively in the plots beginning 15 years after treatment. Soybean seeds contained dieldrin, endrin, heptachlor epoxide, and α and γ BHC; endrin transformation products, which include endrin aldehyde, endrin alcohol, and endrin ketone; and a γ-BHC degradation product, pentachlorcyclohexene. Only BHC and dieldrin were found in crop seeds other than soybeans, and no aldrin, isodrin, heptachlor, chlordane, toxaphene, or Dilan were detected in the seeds of any crop. (Author abstract by permission)

73-2375. Spencer, W. F.; Cliath, M. M. (U. S. Dept. of Agr., P.O. Box 1123, Riverside, CA 92592). **Pesticide volatilization as related to water loss from soil.** *J. Environ. Qual. 2(2): 284-289; 1973.* (23 references)

Results of experiments to determine the relationship between pesticide volatilization and water loss from soil indicate that volatilization rate is controlled by diffusion of the pesticide and by mass flow of water to the soil surface. Volatilization of soil-incorporated lindane and dieldrin was measured under conditions whereby the soil surface remained relatively moist while the humidity of the air passing over the soil was varied to regulate water loss from the soil. Water loss accelerated pesticide volatilization rate, but only after the soil surface had been depleted of the pesticide, indicating that the enhancement was due to the "wick effect," whereby pesticides move to the soil surface by mass flow in water moving to the surface to replace that evaporated, and not due to the mechanism called "codistillation." There was good agreement between measured increases in volatilization rates and calculated amounts of lindane or dieldrin moving to the soil surface in evaporating water. Lindane is more water soluble than dieldrin and its volatilization was more enhanced by concurrent evaporation of water from the soil surface. At very low relative humidities, dieldrin accumulated at the soil surface; this resulted in rapid volatilization when the surface was again moistened by exposure to a relative humidity of 100%. Results indicate that pesticides carried to the surface in evaporating water will volatilize, either immediately or after remoistening the soil surface following drying. Desorption isotherms relating soil pesticide concentrations to soil solution concentrations should be useful in predicting volatilization rates associated with evaporating water. (Author abstract by permission)

73-2376. Scifres, C. J.; Allen, T. J.; Leinweber, C. L.; Pearson, K. H. (Dept. of Range Sci., Texas A & M Univ., College Station, TX 77843). **Dissipation and phytotoxicity of dicamba residues in water.** *J. Environ. Qual. 2(2): 306-309; 1973.* (17 references)

The herbicide, 3,6-dichloro-*o*-anisic acid (dicamba), dissipated most rapidly from water under non-sterile, lighted conditions. Pond sediment evidently contained microbial populations capable of decomposing the herbicide. Temperature was crucial in dicamba dissipation, especially in the presence of sediment. Influence of sediment on dissipation rate of dicamba was apparently augmented by light in some cases. Under summer conditions dicamba at 4.4 kg/ha per surface area of ponds dissipated at about 1.3 ppm/day. Dicamba dissipated as a logarithmic function of concentration with time. Reaction of seedling crops to irrigation water containing dicamba varied among species and cultivars. Relative tolerance from these studies was ranked from most to least tolerant as follows: sorghum [*Sorghum bicolor* (L.) Moench. 'RS-626' and 'Pioneer 820'] > cotton (*Gossypium hirsutum* L. 'Blightmaster' > 'Paymaster' > 'Dunn') > cucumbers (*Cucumis sativa* L. 'Straight eight'). (Author abstract by permission)

73-2377. Kaku, S. (Sch. of Pub. Health, Fac. of Med., Kurume Univ., Kurume, Fukuoka, Japan). **[An epidemiological study on organochlorine pesticide contamination. On the pesticide residues in the plasma of so-called healthy Japanese in 1971.]** *Kurume Igakkai*

Zasshi (J. Kurume Med. Ass.) 36(5): 307-326; 1973. (22 references) (Japanese)

β-BHC, *p,p'*-DDE, *p,p'*-DDT, and dieldrin contents were determined in the plasma of 176 people both male and female not occupationally exposed to these pesticides. The study was done in Fukuoka Prefecture where the pesticide pollution of foods, soils, and living creatures is serious. Recovery of these pesticides by GC was 93, 98, 99.8, and 98%, respectively for β-BHC, *p,p'*-DDE, *p,p'*-DDT, and dieldrin. The average β-BHC content was 57.74 ppb. Residues in males were significantly higher than in females, suggesting a relationship between the environment, the ingestion of animal fats and proteins, and the content of β-BHC. The highest value of 242.3 ppb was found in Japan compared to the highest American value of 15.0 ppb. The average value of *p,p'* (DDE + DDT) was 28.50, 34.11 ppb in males and 22.63 ppb in females. The intake of animal fats and proteins seems to have no primary relationship to the content of DDT derivatives in the plasma.

73-2378. Cole, H. A. (Min. of Agr., Fisheries and Food, Fisheries Lab., Lowestoft, Suffolk, England). **North Sea pollution.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 3-10.* (29 references)

The North Sea is often used for waste disposal. The effects of such disposal on the biological productivity of the oceans and their living resources are not known. Levels of highly toxic organochlorine pesticides such as dieldrin, aldrin, endrin, and DDT have been declining since 1968 due to a lessening in use of these chemicals by countries draining into the North Sea. However, levels of organochlorine pesticide residues remain high in some North Sea fish and are increasing in seals and seabirds. Declines of crustacea populations have been attributed to pesticides. Although most countries abutting the North Sea are endeavoring to eliminate the use of non-biodegradable pesticides which may accumulate in biological materials, there is little work done on the effects of such chemicals on marine fish and shellfish and their food. It is suggested that controlled studies of the potentially toxic pollutants' effects on growth, physiology, behavior and breeding are necessary. Also needed is a convenient bioassay technique.

73-2379. Dybern, B. I. (Inst. Marine Res., Lysekil, Sweden). **Pollution in the Baltic.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 15-23.* (4 references)

Mercury compounds have been used heavily by Finland and Sweden as fungicides and slimicides in the paper and pulp industry which frequently dump wastes into the Baltic. Results of the use of mercury are being found in fish from many inland and coastal waters from Denmark, Finland, and Sweden. Although the use of mercury is now restricted, high mercury contents in fish have interfered with the fishing trade. Fish with a mercury content higher than 1 mg/kg cannot be sold although the fisherman may eat them himself at his own risk. DDT, DDD (TDE), DDE, and PCB contents were also investigated and monitored in fish, seals, and fish-eating birds from the Baltic and Swedish coasts. DDT and PCB accumulated considerably in animals from the Baltic and Oresund; the PCB contamination seems to come from industries and paints which are also dumped into waters. High values of both compounds were found in white-tailed eagles, Guillemot eggs, and seals. Although aldrin, endrin, DDT, and lindane have been banned in many countries, their residues in the open sea suggest that they may be transported by air.

73-2380. Fonselius, S. H. (Fishery Board of Sweden, Goteborg 4, Sweden). **On eutrophication and pollution in the Baltic Sea.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 23-28.* (8 references)

The residence time of water in the Baltic is 24 years. Only about 2.85% of any non-decomposing and non-precipitating material will be removed annually and therefore, an accumulation of 35 times the annual discharge amount will occur. DDT and polychlorinated biphenyls are examples of long-lived pollutants which accumulate under these conditions. Tissues or organisms belonging to the marine food chain in the Baltic contain 8 to 10 times higher concentrations of DDT and polychlorinated biphenyls than those in Swedish west coast, British, or Canadian areas. Concentrations of DDT and polychlorinated biphenyls increase in the food chain so that animals at the top have the highest concentrations. The thin surface film on natural waters consists mainly of fats and fatty decomposition products from dead plankton organisms. DDT, concentrated in this lipid film, may interfere with phytoplankton growth with serious long-term consequences for marine life. Mercury is another accumulating contaminant. International cooperation for pollution abatement in the Baltic has been excellent, but worldwide pollution control measures are needed.

73-2381. Kneip, T. J.; Howells, G. P.; Wrenn, M. E. (Inst. Environ. Studies, New York Univ. Med. Cent., New York, NY 10016). **Trace elements, radionuclides and pesticide residues in the Hudson River.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 169-173.* (20 references)

Concentrations of radionuclides, with the exception of the naturally occurring radium-228, are generally far below the regulatory limit in the Hudson River. However, trace metal and pesticide values sometimes exceed permitted levels. Significantly elevated pesticide concentrations are sometimes found in backwaters of the river, presumably reflecting localized

seasonal input. Pesticide concentrations are naturally several times higher than those in water. Samples of fish flesh and sturgeon taken from the Hudson in 1969 contained from one-tenth to three times the guideline limits for dieldrin as established by the FDA, even though the concentration of dieldrin in the water of that area was fairly low. Concentration factors (ratios of pesticide residues in organism to residues in water) of 1,000:1-7,500:1 have been found for plankton, algae, and bivalves; 1,500:1-50,000:1 for fish; and 50,000:1-150,000:1 for birds in the Hudson River biota.

73-2382. Holden, A. V. (Freshwater Fisheries Lab., Pitlochry, Scotland). **Monitoring organochlorine contamination of the marine environment by the analysis of residues in seals.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 266-272.* (14 references)

Seal blubber analyses have shown that Arctic, Antarctic, and Pacific Ocean waters have a lower concentration of organochlorine pesticide residues than do the waters of the Baltic, North Sea, and Irish Sea wherein the residue in terms of wet weight of blubber was as high as 2.3 ppm for dieldrin, 16.4 ppm for DDT derived compounds, 2.6 ppm for TDE, 20.7 ppm for DDT, and 212 ppm for polychlorinated biphenyls. Dieldrin and polychlorinated biphenyl levels are highest around Great Britain. The highest DDT levels were recorded in the Baltic and Gulf of St. Lawrence. In areas such as the northern Scottish waters, where the seals feed primarily on cod which itself contains organochlorine residues on the order of 0.005 ppm, the seal blubber samples contained two hundred times as much total DDT and polychlorinated biphenyls as samples from other areas and about 50 times as much dieldrin. Although there is no direct evidence of harmful physiological effects to the seals, those in which the highest concentrations of pesticide residues were found were either dead, dying, or in poor condition. It is suggested that enzyme induction may occur in mammals as in birds.

73-2383. Koeman, J. H.; Van Genderen, H. (Inst. Vet. Pharmacol. Toxicol., Univ. Utrecht, The Netherlands). **Tissue levels in animals and effects caused by chlorinated hydrocarbon insecticides, chlorinated biphenyls, and mercury in the marine environment along the Netherlands coast.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 428-435.* (14 references)

Results of studies of the pesticide content in tissues of dead or dying birds are presented. Proof of pesticide lethality can be determined from the residues in the liver and brain. Telodrin was particularly toxic for terns and eiders. Endrin, while present in relatively high concentrations at the lower trophic levels, was found only in low concentration in the tissues of terns and eiders, indicating that this particular insecticide is less hazardous for higher trophic levels. Poisoning of terns occurred in two distinct stages: very soon after hatching, attributed to resorption of the yolk sac; and as the birds learned to fly. It is reasoned that the increased energy used in the attempt to fly released chlorinated hydrocarbons from the fat deposits. The conspicuous increase in death of female eiders at the end of the breeding cycle is explained by the fact that the females took in little or no food during the incubation period, using up the fat stores of their bodies which released the stored chlorinated hydrocarbon residues.

73-2384. Stout, V. F.; Beezhold, F. L.; Houle, C. R. (Nat. Marine Fish. Serv., Tech. Lab., Seattle, WA 98102). **DDT residue levels in some U.S. fishery products and some treatments in reducing them.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 550-553.* (12 references)

DDT contents were studied in various species of fish. The DDT content in fish is always greater in the liver than in the flesh, usually in the range of 20-50 times, and is too closely associated with the muscle components in the fish to be removed by some prepackaging process. In some fish, such as salmon, trimming of the skin and fatty deposits in the dorsal median, lateral line, and belly flap areas does bring the total DDT level down, but this is practical only in fish of very high monetary value. The fate of DDT during the processing of fish to produce fish protein concentrate has been studied. It is possible to produce an edible oil fraction with a very low concentration of DDT because of the solubilizing effects of phospholipids for organic molecules. Fish meal contains less than one tenth the DDT concentration found in the oil. Deodorization, used for removing almost all chlorinated hydrocarbons from edible vegetable oil, is too expensive to use for processing animal feed. The combined use of hydrogenation and deodorization is most effective in removing some DDT derived compounds from menhaden oil.

73-2385. Reifenstein, H.; Heinisch, E. (Inst. fuer Pflanzenschutzforsch. Kleinmachnow, Akad. Landwirtschaftswiss. DDR, Kleinmachnow, DDR). **Rueckstandsuntersuchungen an Moehren nach Behandlung mit Prometryn, Propazin und Chlorpropham. [Residue investigations in carrots following treatment with prometryne, propazine, and chlorpropham.]** *Nachrichtenbl. Pflanzenschutzdienst DDR 27(4):84-86; 1973.* (6 references) (German)

Propazine, prometryne, and chlorpropham residues in carrots and soil treated with single or fractionated doses of 2-3 kg of Uvon (prometryne) and 8 kg of Probanil (propazine plus chlorpropham) per ha were investigated. The prometryne residues in carrots were below 0.03 ppm in most cases, and a value of 0.15 ppm, against a maximum allowable concentration of 0.1 ppm, was measured in 1 out of a total of 46 samples. Both the

propazine and chlorpropham residue levels were usually below 0.025 ppm, and never reached the maximum allowable content in the samples investigated. The propazine and prometryne contents in the upper 15 cm soil layer were 0.02-0.3 ppm and below 0.02 ppm, respectively. The application of Uvon and Probanil in carrot growing does not create residue problems provided the recommended waiting periods are observed.

73-2386. Curley, A.; Burse, V. W.; Jennings, R. W.; Villanueva, E. C.; Tomatis, L.; Akazaki, K. (Environ. Protect. Agency, Chamblee Toxicol. Lab., Chamblee, GA 30341). **Chlorinated hydrocarbon pesticides and related compounds in adipose tissue from people of Japan.** *Nature (London) 242(5396): 338-340; 1973.* (13 references)

A procedure was developed and applied for the analysis of chlorinated hydrocarbon pesticide residues in adipose tissues obtained from Japanese residents at autopsy. The mean concentrations obtained by electron capture gas-liquid chromatography were 0.14 ppm α-BHC, 1.28 ppm β-BHC, 0.12 ppm γ-BHC, 0.03 ppm *o,p'*-DDE, 1.78 ppm *p,p'*-DDE, 0.08 ppm *o,p'*-DDT, 0.54 ppm *p,p'*-DDT, 0.04 ppm *p,p'*-DDD (TDE), 0.02 ppm heptachlor epoxide, 0.13 ppm dieldrin, and 0.08 ppm hexachlorobenzene. These values were in good agreement with those previously reported (see Abstract no. 72-2305). All samples analyzed were positive for polychlorinated biphenyls (PCBs). Two-column gas chromatography, Coulson conductometry, and Florisil elution patterns were accepted as confirmation for the presence of all reported compounds except hexachlorobenzene and PCBs. HCB was confirmed by passage of samples, dissolved in hexane, over a deactivated silica gel column and elution with hexane. The combined eluates were analyzed with electron-capture and electrolytic-conductometric detectors. The composite was also cleaned up on a silica gel TLC plate and *p*-values determined for hexane extracts of the composite spot. The quenching of the hexachlorobenzene standard and the composite sample spot were also observed under ultraviolet light. Gas chromatography-mass spectrometry was also used for confirmation of pesticides and PCBs.

73-2387. Paoletti, A. (Cattedra Ig., Fac. Sci., Univ. Napoli, Naples, Italy). **L'Aggressione chimica del mare per opera dell'uomo. [Man-made chemical disruption of the sea.]** *Nuovi. Ann. Ig. Microbiol. 21: 243-269; 1970.* (60 references) (Italian)

Marine pollution by products of modern technology, including pesticides, is discussed. Talc used as a carrier and diluent for DDT was recently found in glaciers. DDT reached 0.3 ppm in glacier layers deposited in 1964 while absent in those prior to 1944. DDT sprayed in Africa was conveyed on talc particles to Barbados and the Caribbean Islands. An approximate 600 kg/year DDT deposition in certain areas of the Atlantic Ocean was computed to occur through air current transport. DDT residues were found in seal and whale blubber and ranged between 0.1 and 14 ppm in ocean fish. DDT and PCB in 5:1-10:1 ratios, respectively, were found in marine bird eggs. Mercury and arsenic were constant constituents of the San Francisco Bay smog. Large amounts of arsenic were found in storm runoff in Japan. Fish were estimated to contain 1000-10,000 times as much mercury as compared to the water of their environment. A significant increase in mercury levels occurred in bird feathers and fish caught along the Swedish coasts between 1940 and 1950 coinciding with the introduction of alkylmercury compounds into agricultural use.

73-2388. Del Vecchio, V.; Leoni, V.; Pucetti, G. (Ist. Ig., Univ. di Roma, Rome, Italy). **La contaminazione da pesticidi dei principali bacini idrografici Italiani durante il 1969 ed indici proposti per una sua valutazione igienica. [Pesticide contamination of the main catchment areas of Italy in 1969 and proposed criteria for evaluating their hygienic significance.]** *Nuovi Ann. Ig. Microbiol. 21(5): 381-451; 1970.* (118 references) (Italian)

Organochlorine and organophosphate levels were determined in the 12 principal rivers as well as Lakes Garda and Bracciano, representing the major catchment areas of Italy, in 1969. Semi-automated liquid-liquid extraction of 10-25 liter water samples was followed by preliminary cleanup of the extracts by partitioning in acetonitrile-petroleum ether. Preliminary tests were performed on an aliquot of the extract to detect the presence of organophosphates by enzyme-TLC methods; the remaining extract was chromatographed on a silica gel microcolumn for further cleanup and to separate the pesticides into four groups. Final detection employed gas chromatography with electron capture and flame ionization detectors. DDT was found in 100% of the samples examined, BHC in 100%, lindane in 96%, dieldrin in 59%, heptachlor in 37%, aldrin in 12%, heptachlor epoxide in 10%, endosulfan in 8%, ronnel in 37%, parathion in 16%, methylparathion in 16%, malathion in 8%, and chlorpyrifos in 8%. Other organophosphates were present but not identified. The most highly contaminated basins were those of Ofanto, Ticini, Tevere, Reno, Tirso, and Salso. The highest contamination levels, found in February-May, were 0.0245-0.2285 ppb for total organochlorines, and 0.14-2.81 ppb of total anticholinesterase activity expressed as parathion, with individual maximum levels of 0.0752 ppb ronnel, 0.0729 ppb parathion, 0.0124 ppb methylparathion, 0.1260 ppb diazinon, 0.7031 ppb malathion, and 0.0480 ppb chlorpyrifos.

73-2389. Grasso, C.; Lanciotti, E.; Bernardi, G. (Ist. Ig., Univ. di Firenze, Florence, Italy) **Ricerca e titolazione di insetticidi clorurati nel latte parzialmente scremato di**

due centrali della Toscana. [Detection and identification of chlorinated pesticides in partially skimmed milk samples collected in two dairy centers in Tuscany.] *Nuovi. Ann. Ig. Microbiol. 22(6): 434-445; 1971.* (19 references) (Italian)

Fat content and organochlorine pesticide contamination in skimmed milk samples were studied 15 min prior to and 15 min after pasteurization at 80°C for 15 to 17 seconds. Fat content ranged between 1.8 and 2.2% in all the milk samples collected from two dairy centers in Tuscany and was not affected by pasteurization. Total organochlorine residues ranged from 0.00074 to 0.04063 ppm and DDT varied from 0.00021 to 0.03622 ppm. Average α-BHC, lindane, heptachlor, aldrin, heptachlor epoxide, DDE, dieldrin, DDD (TDE) and *p,p'*-DDT levels were far below the maximum allowable limits and showed no significant changes upon pasteurization; no differences in contamination levels between the two dairies were observed.

73-2390. Burge, W. D. (U. S. Dept. of Agr., Agr. Res. Serv., IAEQ, Biological Waste Mangement Lab., Beltsville, MD 20705). **Transformation of propanil-derived 3,4-dichloroaniline in soil to 3,3',4,4'-tetrachloroazobenzene as related to soil peroxidase activity.** *Soil Sci. Soc. Amer. Proc. 37(3): 392-395; 1973.* (20 references)

Contrary to reports in the literature, no correlation was found between the peroxidase activity of five soils or the numbers of peroxidase-producing microorganisms and the abilities of the soils to condense 3,4-dichloroaniline (DCA) derived from the hydrolysis of *N*-(3,4-dichlorophenyl) propionamide (propanil) to 3,3',4,4'-tetrachloroazobenzene (TCAB). Amending the soils with an energy source increased the production of peroxidase extractable from the soil but decreased the amount of TCAB formed. It has been reported that a peroxidase-producing fungus isolated from soil was capable of converting DCA to TCAB. However, peroxidase isolated directly from a soil of this study was incapable of converting DCA to TCAB. Apparently not all soil peroxidases catalyze the conversion. (Author abstract by permission)

73-2391. O'Connor, G. A.; Wierenga, P. J. (Dept. of Agron., New Mexico State Univ., Las Cruces, NM 88003). **The persistence of 2,4,5-T in greenhouse lysimeter studies.** *Soil. Sci. Soc. Amer. Proc. 37(3): 398-400; 1973.* (8 references)

The persistence of 2,4,5-T was evaluated in an agricultural soil under favorable microbial conditions in lysimeters. Degradation was most rapid in a soil previously treated with the herbicide if extended periods of time did not separate herbicide additions. The degradation of 2,4,5-T was more rapid when the herbicide was applied at 40 ppm than when it was applied at 80 ppm. The time required for biological detoxification varied from 43 to 85 days depending upon pretreatment and concentration of the applied herbicide. (Author abstract by permission)

73-2392. Anderson, W. L.; Greenberg, R. E.; Duzan, R. E.; Kjos, M. A. (Ill. Natural History Survey, Urbana, IL 61801). **Concentrations and distributions of *p,p'*-DDE, dieldrin, and heptachlor epoxide in pheasants in east-central Illinois.** *Trans. Ill. State Acad. Sci. 63(4): 373-382; 1970.* (7 references)

p,p'-DDE, dieldrin, and heptachlor epoxide were detected in 97, 69, and 75% of 147 pheasants collected in 1968. DDE residues were highest in livers (mean of 0.28 ppm) and visceral and subcutaneous fat. Levels of dieldrin and heptachlor epoxide were highest in subcutaneous fat, followed by visceral fat and then ovaries. No significant sex-age differences were noted although adult hens probably carried higher levels of dieldrin and heptachlor epoxide than juvenile hens. Levels of all three toxicants began to increase in late April and fell off from July to October. Highest individual concentrations observed were 3.26 ppm (liver) for DDE, 5.76 ppm (subcutaneous fat) for dieldrin, and 4.76 ppm (subcutaneous fat) for heptachlor epoxide. These levels were not considered hazardous to the pheasants.

See also 73-2307 73-2312 73-2405 73-2407 73-2523 73-2325

73-2393. Watson, M.; Benson, W. W. (Dept. Agr., Boise, ID 83702). **Chronicle of a cropduster crash: a devastating and avoidable tragedy.** *Aerospace Med. 44(5): 549-551; 1973.* (6 references)

A midair collision of two cropduster planes involved in night spraying of organophosphate insecticides killed both pilots and a woman in a farmhouse into which one of the planes crashed, and also precipitated two heart attacks and contaminated a herd of dairy cattle. The cargo of one of the planes, demeton, trichlorfon, and naled, was jettisoned over a pasture, causing the death of two of the herd of 40 cows and resulting in residues of trichlorfon and naled within tolerance limits in milk from the herd. Although it is possible that depressed ChE levels, found in blood recovered during autopsy of the pilots, might have contributed to the crash, the two companies were operating without collision lights on two adjacent fields separated by a low ridge, probably without radio communication. The incident illustrates the need for more stringent regulations governing operation of spray aircraft as well as monitoring of the physical conditions of pilots using organophosphates.

73-2394. Sovljanski, M.; Popovic, D.; Tasic, M.; Sovljanski, R. (Dept. Forensic Med., Fac. Med., Novi Sad, Yugoslavia). **Intoxications with dinitroorthocresol.** *Arh. Hig. Rada Toksikol. 22: 329-332; 1971.* (8 references)

Four cases of lethal intoxication with DNOC (Yellow Oil E5 formulation) were recorded in Novi Sad in the first half of 1971. The two accidental cases resulted from extreme negligence of self protection during spraying of fruit trees. Death in each case was a result of asphyxiation from a bolus of food which had not been swallowed properly after acute symptoms had disappeared. The highest residue of DNOC was found in the kidney in both accidental and suicidal cases. The two suicide deaths occurred during the phase of acute poisoning, and post mortem examination of these cases showed agonal inhalation of gastric contents. Intoxication with DNOC may have local influence on the complex reflex act of swallowing, and influence on the complex relationship among different parts of the CNS which may participate in the act of swallowing.

73-2395. Nienhaus, H.; Ehrenfeld, M. (Pathol. Inst. Staedtische Krankenanstalten Bielefeld, Bielefeld, Germany). **Zur Pathogenese der Lungenerkrankung durch Paraquat. [Pathogenesis of lung disease in paraquat poisoning.]** *Beitr. Pathol. 142(3): 244-267; 1971.* (30 references) (German)

A case of lethal paraquat poisoning and the pathogenesis of the lung disease in acute paraquat poisoning are presented. After accidentally ingesting 2 g of paraquat, a 53-year-old male died 52 hr later due to respiratory failure. An autopsy revealed gradual destruction of the alveolar walls with the changes starting along the alveolar surface and progressing through the alveolar wall to involve the blood vessels. Desquamation of the epithelial cells, protein-rich intra-alveolar edema, rupture of capillaries, widespread hemorrhages, and finally, disintegration of the basement membranes and the supporting tissues characterized the pulmonary involvement. The destruction of the pulmonary parenchyma was enhanced by cessation of microcirculation. The arterioles, venules, terminal bronchioles, and adventitia which are not destroyed in acute paraquat poisoning serve as the matrix for regeneration. Thus complete restoration of the destroyed parenchyma is not possible, and fibrosis or cirrhosis must develop during the recovery phase. In the presence of reducing substances paraquat forms a radical which binds oxygen, forming unstable peroxides. The peroxide in turn breaks down, releasing activated oxygen. The activated oxygen causes indiscriminate destruction of organic substances. Oxygen therapy is strongly contraindicated in paraquat poisoning.

73-2396. Randall, J. E. (Bernice P. Bishop Museum, Honolulu, Hawaii 96818). **Chemical pollution in the sea and the crown-of-thorns starfish (*Acanthaster planci*).** *Biotropica 4(3): 132-144; 1972.* (57 references)

One of the most likely explanations for the current infestations of the starfish *Acanthaster planci* in reefs throughout the world is the effect of pollutants like dieldrin and DDT on plankton. Domestic and agricultural use of pesticides is moderate to heavy in many well-populated insular areas which have starfish infestations. A concentration of one of the pesticides in the sea must be sufficient to reduce the population of one of the predators (zooplankters) of the starfish without affecting larvae themselves. A contributing factor might be the increase in food supply for the larvae as a result of toxicity to certain phytoplankton. Although some authors believe that normal fluctuations account for the increases in *Acanthaster* populations, the magnitude of some of the plagues seems too great for this explanation.

73-2397. Damluji, S. F.; Amin-Zaki, L.; Elhassani, S. B. (Med. Coll., Baghdad Univ., Baghdad, Iraq). **Mercury in the environment.** *Brit. Med. J. 4: 489; 1972.*

A Letter-to-the-Editor cites remarkable improvement of function in cases of mercury poisoning in Iraq as evidence that rehabilitation of such victims is possible and that the help of international organizations such as WHO would be valuable. Although cellular necrosis observed in the brain of many victims is clearly irreversible, all cases graded as mild or moderate have made great progress on physical therapy. Many of those completely paralyzed and bedridden began to care for themselves and walk around after several weeks of physical therapy. Partial sight was recovered in some cases and partial hearing in others, even when no drugs were administered.

73-2398. Henny, C. J.; Schmid, F. C.; Martin, E. M.; Hood, L. L. (Migratory Bird Populations Station, Laurel MD 20810). **Territorial behavior, pesticides, and the population ecology of red-shouldered hawks in central Maryland, 1943-1971.** *Ecology 54(3): 545-554; 1973.* (38 references)

The number of breeding pairs of red-shouldered hawks was reported as 7 in 1947 and 3 in 1971 in the Laurel flood plain, where a large population increase has brought land fills, apartment buildings, and shopping centers. Two other flood plains in the study area, both relatively untouched by human activities, supported either the same number or a greater number of nests in 1971 compared to 1947. Relatively low levels of DDE, DDD, DDT, dieldrin, heptachlor epoxide, and polychlorinated biphenyls were found in three eggs taken from the study area. Although these may have been sufficient to cause the observed 9% decrease in eggshell thickness, it is doubtful that they had any detrimental effect on the reproductive performance of the population. The number of young fledged per nesting pair seemed to depend on the population density of the area.

73-2399. Alsop, F. J. (Univ. Tennessee, Knoxville, TN). **Eggshell thickness from red-winged blackbird (*Agelaius phoeniceus*) populations with different exposures to DDT.** *Diss. Abstr. Int. 33(11): 5571B; 1973.*

Red-winged blackbird eggs collected in 1970 and 1971 from areas in Florida, Arkansas, Mississippi, and Tennessee had significantly thinner shells than eggs collected from the same areas before DDT was introduced. Eggs collected from cotton and truck farm areas had a mean shell thickness 18.2% less than those collected from the same areas before DDT use while the overall reduction was 7.2%. No pesticide analyses were run on the birds or their eggs in this study. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-12,379.)

73-2400. Longcore, J. R. (Bureau Sport Fish. Wildl., Patuxent Wildl. Res. Cent., Laurel, MD). **The effects of certain pesticides on wildlife.** *IN: Eighth Northeast Aerial Applicators Conference. J. E. Dewey et al. eds., Washington, 1972, pp. 86-95.* (41 references)

The toxicity of pesticides to wildlife depends on the nature of the chemicals and on the susceptibility of the species involved. A 10-fold difference in LD50s of a given compound is not unusual for different species. In general, the organochlorines, which are quite toxic to fish and birds, are concentrated and retained in tissues, causing delayed effects on reproduction or other functions. Organophosphates and carbamates can be more acutely toxic to mammals although malathion and carbaryl are considered relatively safe and do not persist. Paris green, a larvicide, does not persist in the aquatic environment and is not highly toxic to birds, but its use has been questioned because of its arsenic content. Exposure of wildlife to pesticides can result from agricultural and forestry uses, chemical manufacturing processes, and urban sewage. Pinpointing sources of pollution is the basis for correcting an undesirable situation.

73-2401. Crossland, J.; Shea, K. P. (Author address not given). **The hazards of impurities.** *Environment 15(5): 35-38; 1973.* (29 references)

While attention has been focused on the toxicity of persistent pesticides, the toxicity of products of side reactions in the manufacture of these and other chemicals has gone unnoticed for many years. Dioxins, which have been found as contaminants in a number of pesticides like 2,4,5-T, derived from chlorophenols, are lethal at levels 1000 times lower than the pesticides themselves. The "chick edema factor," which caused the accidental poisoning of millions of chickens in 1957, was finally identified in 1966 as hexachlorodibenzo-*p*-dioxin. Chlorodibenzofurans have been found in pentachlorophenol and are also believed responsible for the differences in toxicity observed with different polychlorinated biphenyls produced by different manufacturers. Chloracne has been produced in humans as a result of exposure to several of these contaminants. Tetrachlorodibenzodioxin produced acne on the rabbit ear at concentrations of 0.05 to 0.001%. Effects on offspring such as gastrointestinal hemorrhages have been observed following doses of from 0.125 to 2 μg/kg TCDD. Persistence of dioxins in the soils has been demonstrated but bacterial formation of dioxins from dichlorophenol and trichlorophenol did not occur under laboratory conditions.

73-2402. Zaun, H.; Neumann, K.; Werner, G. (Hautklinik, Univ. d. Saarlandes, Homburg/Saar, Germany). **Die Feinstruktur dystrophischer Haare bei Vitamin A- und Thallium-Intoxikation. [The fine structure of the hair in vitamin A and thallium poisoning.]** *Hautarzt 23: 544-550; 1972.* (15 references) (German)

Dystrophic changes in the hair of two patients with vitamin A and thallium poisoning are described. Electron microscopic studies of the dystrophic hair ends revealed extensive destruction of the cuticle, fissures in the cortex, and disorganization of the keratin, as well as proliferation of melanin granules with structural and distributional anomalies of melanin granules.

73-2403. Eliahou, H. E.; Almog, C.; Gura, V.; Iaina, A. (Dept. Nephrol., Chaim Sheba Med. Cent., Tel-Hashomer, Israel). **Treatment of paraquat poisoning by hemodialysis.** *Israel J. Med. Sci. 9(4): 459-462; 1973.* (18 references)

Intensive and prolonged hemodialysis was believed responsible for the favorable outcome of two cases of paraquat poisoning with renal, hepatic, and pulmonary involvement. The first patient, who intentionally swal-

lowed a mouthful of 10% paraquat solution, was treated by dialysis for 16 hr the day after ingestion and for a total of 141 hr thereafter. Clinical improvement began about the 16th day, and recovery was slow but complete. The second patient, who was accidentally sprayed with a jet of paraquat solution, recovered uneventfully after a 68-hr prolonged hemodialysis. Forced diuresis by the infusion of mannitol and other fluids together with furosemide was not possible in either case due to renal damage.

73-2404. Rosen, F. L. (Maplewood, NJ). **Air pollution. Are we winning or losing the battle?** *J. Med. Soc. New Jersey 70(3): 193-195; 1973.* (1 reference)

Although it was recognized in the 1960s that air pollutants contributed to chronic respiratory diseases, little has been done to reduce the problem. Incidents brought about by pesticides, auto exhaust, and industrial and other pollutants continue to occur. A 9-yr old boy recently treated for asthma had been exposed to insecticide spray at day camp. Many camps spray grounds daily with insecticide and sufficient time is not always allowed for complete dispersion of the vapor.

73-2405. Trites, R. W. (Marine Ecol. Lab., Fisheries Res. Board of Canada, Bedford Inst., Dartmouth, Nova Scotia, Canada). **The Gulf of St. Lawrence from a pollution viewpoint.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 59-72.* (44 references)

Quebec and the Atlantic Provinces are the last North American stronghold for Atlantic salmon and Eastern brook trout, both of which must spend at least two years of their early life in fresh water. These areas are also great timber producers, and extensive aerial spraying of DDT has been practiced there since 1952 for control of the spruce budworm. Effects on fish were particularly serious in the first years: 50-98% mortality of young salmon was recorded in some areas. Organophosphates have now largely replaced DDT and seem much less harmful to fish. The half-life of DDT is measured in decades, so large amounts of the material applied may still be circulating in the Gulf of St. Lawrence area. Airborne and waterborne pesticides from agricultural watersheds probably enter the Gulf as well. The gannet colony off the Gaspe coast is suffering from eggshell thinning at present. Analysis of mackerel, which comprise much of the gannet's diet, revealed appreciable DDT contamination although this may have been acquired during the mackerels' residence in other areas along the North American coast. The generally low level but ubiquitous occurrence of pollutants in the Gulf of St. Lawrence does not preclude the possibility of both emergencies and chronic effects.

73-2406. Nitta, T. (Tokai Regional Fisheries Res. Lab., Tokyo, Japan). **Marine pollution in Japan.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 77-81.*

Until recently, agricultural chemicals caused problems only in fresh waters where the effects of rice paddy culture were felt; loach, carp, and shrimp were injured by pesticides, but few of the coastal animals had been affected. However, large scale death of mysid shrimp occurred in Ariake Bay and other waters, especially where agricultural plains covered the basins of the contributing waterways. Soft clams and some fish were also damaged by agricultural pesticides, once again around Ariake Bay. Because of unusual weather PCP was spread over paddy fields in the basin of the Chikugo River. Heavy rains carried the chemical into Ariake Sea and Lake Biwa where many species of fish died. Since these diasters the use of pesticides which are especially harmful to fish have been monitored to prevent future incidents.

73-2407. Butler, P. A.; Childress, R.; Wilson, A. J. (Gulf Breeze Biol. Lab., U.S. Dept. Interior, Gulf Breeze, FL 32561). **The association of DDT residues with losses in marine productivity.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 262-266.* (13 references)

The correlation between levels of DDT in oysters and the reported amounts of DDT used on agricultural land in an associated drainage basin in Texas is striking. Seatrout, which feed primarily on shrimp and menhaden, were particularly affected by DDT concentrations in waters where menhaden were their chief food. Shrimp will die before they build up significant levels of DDT, but menhaden live to build up large reserves of the pesticide before being eaten by the seatrout. Due to metabolic incorporation of DDT into the developing eggs of the seatrout, extensive reproductive failure of the species occurred in Laguna Madre, Texas, in 1969. It has been established that biological systems may become saturated with a given pollutant when environmental loading is relatively constant. It is suggested that estuarine sediments build up to a plateau level of DDT residues over a period of years, and these residues do not reflect seasonal changes seen in the waterborne pesticide. Severe storms may bring about a change in this plateau and cause recycling of the pollutant. In the Arroyo Colorado in 1969, DDT residues in juvenile menhaden fell to less than half those of the previous year due to restrictions on the agricultural use of DDT effective in 1966-67. This decline may allow restoration of the reproductive capacity of the seatrout in time.

73-2408. Trautmann, A. (Inst. Pharmakol., Westfaelische Wilhelms-Univ., Muenster, Germany). **Die Dialyse von Arzneimitteln und Giften. [Dialysis of drugs and poisons.]** *Med. Klin. 67(46): 1525-1531; 1972.* (29 references) (German)

Possibilities are reviewed of eliminating various medicaments and poisons, including pesticides, from the

human body by dialysis. Early hemodialysis is essential in the therapy of acute mercury poisonings. The high value of dialysis combined with dimercaprol therapy in the treatment of these poisonings was evidenced in animal tests. Hemodialysis is equivalent to diuresis in the treatment of acute poisonings with arsenic acid. Copper sulfate was readily dialyzable. A thallium clearance of 166 ml/min at a flow rate of 174 ml/min was determined in vitro. Mild cases of paraquat poisoning are best treated by forced diuresis, and serious poisonings require a combination of the former with hemodialysis. Successful peritoneal dialysis in cases of sodium chlorate poisoning has been reported. Despite low dialyzability, a combination of dialysis by means of an artificial kidney with atropine and obidoxime therapy is effective in the treatment of methylparathion poisonings. A high efficiency of hemodialysis in poisonings with dinitro-*ortho*-cresol (DNOC) was determined.

73-2409. Nisbet, I. C. T. (Massachusetts Audubon Society, Lincoln, MA 01773). **DDE in eggs and embryos of brown pelicans.** *Nature (London) 242(5396): 341-342; 1973.* (22 references)

Further criticism of Hazeltine's remarks (see Abstract no. 73-0346) on DDE and eggshell thinning is offered in a Letter-to-the-Editor. Hazeltine's claim that DDE is metabolized by developing embryos seems to be based on a comparison of DDE levels in the yolks of four incubated and five fresh eggs. The difference in whole-egg DDE residues between incubated eggs (mean 2.53 mg) and fresh eggs (3.62 mg) was not statistically significant for this small sample, and could be readily explained by the fact that eggs with higher DDE levels are more frequently broken during incubation, and thus less frequently available for collection. For the same reason, samples of incubated eggs are expected to have thicker shells, on the average, than fresh eggs. This was true in Hazeltine's sample (means 0.390 and 0.372 mm). Hazeltine's statement that eggshell thickness was positively correlated with DDE concentration in the lipids of the "yolk" (actually yolk plus embryo) is misleading since yolk lipids are metabolized during incubation. The use of parametric regression techniques by Blus et al. (see abstract no. 72-0972) in an attempt to define the dose-response relation between DDE and eggshell thinning was justified since such techniques require only that the dependent variable be random and normally distributed around the regression line.

73-2410. Davies, J. E. (Dept. Med., Univ. Miami, Miami, FL). **Effects of different types of exposure of different kinds of pesticides on man as determined through laboratory testing.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers, Washington, 1972, pp. 17-33.* (14 references)

The three types of human exposure to pesticides–accidental, occupational, and incidental–can be measured best in the laboratory. Diagnostic tests, useful in acute poisonings, include measurement of ChE activity and pesticide residues in food, soil, blood, urine, gastric contents, and hair and pesticide metabolite studies of the urine. Biochemical abnormalities and clinical anomalies in long-term high exposure groups of pesticide workers have been relatively few. Laboratories monitoring occupational exposure try to limit and prevent excessive exposure through ChE determinations, urinary metabolite surveys, and analysis of serum pesticide levels. Incidental exposure is measured by monitoring pesticide levels in serum or adipose tissue; such measurement has revealed that with some pesticides, including DDT, exposure is not homogeneous throughout the population.

73-2411. Wolfe, H. R. (Wenatchee Res. Station, PPL, Office Res. Monitoring, Environ. Protect. Agency, Wenatchee, WA). **Protection of individuals who mix or apply pesticides in the field.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers, Washington, 1972, pp. 35-39.* (8 references)

Protecting the four routes of pesticide entry into the body and preventing undue exposure are good insurance against poisoning in workers who mix or apply pesticides in the field. Dermal absorption, the most important entry route, can be minimized through the use of waterproof clothing covering areas of the body likely to come in contact with pesticide formulations. The scrotum and the head and neck areas absorbed the highest amounts of applied pesticide (parathion), while the hands are most often exposed to concentrated formulations. Waterproof clothing is also essential in preventing pesticide entry through cuts or abrasions. Respiratory protection is particularly important in confined spaces where toxic dusts and vapors or very small droplets are used. Respirators should be chosen with the situation in mind and must be maintained properly to be of value. Cigarette smoking during pesticide application has not produced high levels entering through the lungs, but material that is inhaled is 100% absorbed, and burning could trigger formation of more highly toxic compounds. Care must be taken to avoid splashing concentrates or otherwise transferring pesticides to the mouth.

73-2412. Andresen, W. V.; Merkle, C. R. E.; Colehower, W. S.; Shields, M. F. (Industrial Hygiene and Safety, American Cyanamid Company, Wayne, NJ). **Special panel on protective clothing, goggles, gloves and foot coverings–their value during handling and use of pesticides.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers, Washington, 1972, pp. 43-51.*

In the manufacture of organophosphate pesticides American Cyanamid Company has followed a safety pro-

gram which has prevented any serious illness during a 25-year period. The program includes education of the employee on the hazards of the operation, proper plant engineering, provision of protective clothing, a mandatory personal hygiene program, good housekeeping, and periodic blood tests. Protection of applicators depends on impermeable or tightly woven permeable clothing, gloves and boots, avoidance of smoking and eating on the job, respiratory devices, spraying downwind, and care in handling concentrates. Protective clothing has been developed which is lightweight and durable, but the problem of finding an impermeable fabric that breathes has not been solved. The extent of coverage required depends on the job to be done. Eye protection is afforded by full facepiece respirators, full facepiece gas masks, hoods with windows, face shields, and goggles. Full facepiece respirators and gas masks require that headbands or glasses not be worn. Corrective lenses may be fixed to the inside of the equipment, but contact lenses are not recommended. The future availability of air conditioned and filtered tractor cabs will provide protection and comfort for the applicator.

73-2413. Merkle, C. R. E. (Mine Safety Appliances Co., Pittsburgh, PA). **Effectiveness of respirators and similar gear for protection against inhaling pesticides.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers. Washington, 1972, pp. 53-54.*

Pesticides in the form of gases or particles below 5 μ can enter the body through the respiratory system. Protective equipment should be worn whenever the established Threshold Limit Value may be exceeded, and can be either air purifying, air supplied, or self-contained; the choice depends on the pesticide and the situation during application. Most pesticides require the use of an efficient particulate prefilter in addition to chemical "absorbents." All equipment should be maintained properly and checked for tightness before use.

73-2414. Scott, R. (Chemagro Corp., Kansas City, MO). **Ventilation and dust control systems to protect workers in enclosed areas.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers, Washington, 1972, pp. 55-59.* (1 reference)

Of the two types of ventilation which can be used in manufacturing areas, dilution ventilation is the least expensive; however, it does not control the contamination at the source and emits toxic materials to the environment. Local-exhaust ventilation, when properly designed, can remove contaminants before they are spread throughout the room and collect them for recycling. A system recently installed by Chemagro illustrates how a combination of the two types of ventilation can allow production of highly toxic materials without the use of personal respiratory equipment.

73-2415. Hagie, J. R. (Power Sprayer and Duster Council, Farm Industrial Equip. Inst., Chicago, IL). **Innovations in pesticide application equipment that protect workers from exposure to pesticides.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers, Washington, 1972, pp. 61-64.*

A pesticide application safety system begins with the formulator who must establish guidelines for distribution, clean-up, and disposal and recommend antidotes. Education and training of pesticide handlers and applicators, selection and calibration of equipment, and a series of emergency actions to reduce the degree of hazard are all important to the system. The machine-applicator-equipment manufacturers' involvement in the safety system includes training of employers and employees in operation of power equipment, establishing guidelines for sprayer calibration, providing safety devices, such as controlled environment vehicle cabs, and engineering equipment to minimize spray drift and the amount of handling required. A data bank is needed to provide information on causes of accidents in order to improve present practices.

73-2416. Moss, Jr., H. (Shell Chem. Co., San Ramon, CA). **Rules for workers in warehouses where storage of hazardous chemicals necessitates availability and use of protective clothing and safety equipment.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers, Washington, 1972, pp. 83-86.*

The safety of personnel in warehouses where pesticides are stored depends on information and equipment and on good operating and housekeeping practices. Pesticide storage should be identified with prominent, waterproof signs on all sides of the building; police, fire, and public health departments should be informed in writing of the storage layout and antidotes to be used. Smoking should be prohibited and workers trained in safe practices. Segregation of materials of various levels of toxicity from each other and from nonhazardous materials is important, and the building should be locked when not in use.

73-2417. Rogers, M. L. (Rogers Entomological Serv., Cleveland, MS). **Attitudes and practices of pesticide applicators regarding necessary and regular use of protective clothing and safety equipment.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers. Washington, 1972, pp. 87-89.*

Aerial applicators observe safety rules and regulations more than any other group of applicators working in Mississippi. Small father-son teams seem to practice safety precautions more often than day laborers. Early in the cotton season, when more toxic insecticides are used, precautions are more thoroughly observed. Ento-

mologists scouting in the cotton fields generally wear proper clothing, but do not always carry antidotes. The statistics on pesticide poisoning in Mississippi indicate that proper handling of pesticides results in no hazard to the men involved.

73-2418. Fletcher, W. J. (Agr. Safety Eng., Farm Dept., Nat. Safety Council, Chicago, IL). **Pesticide worker accidents–what's happening.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers, Washington, 1972, pp. 91-101.* (28 references)

Relatively few accident reports are being received in a study on pesticide safety undertaken by the Farm Conference on the National Safety Council. However, discussions with farmers and rural physicians indicate that pesticide-related accidents are occurring. Most surveys, except the one continuously going on in California, have not given a general picture of agricultural accidents. Professional pest control contractors have apparently had very few serious mishaps although some of the fatal crashes of aerial applicators have been attributed to depressed ChE levels. A sample of some pest-related incidents in the U.S. shows clumsy handling, leaky equipment, failure to decontaminate quickly, and insufficient treatment responsible for serious poisonings.

73-2419. Davies, J. E. (Dept. Med., Univ. Miami, FL). **Effects of different kinds of exposures on man as determined through laboratory testing.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers, Washington, 1972, pp. 151-154.*

Laboratory data on people occupationally exposed to parathion in Dade County, Florida, in 1965 was compared. Well protected formulators who handled about 65 lbs of the material daily and careful and protected spraymen who handled 10 lbs/day had average monthly RBC ChE levels of 0.69 Δ pH/hr and urinary PNP (paranitrophenol) levels of 0.9 and 0.8 ppm, respectively. Careless spraymen who handled 11 lbs of the material had ChE levels of 0.59 Δ pH/hr and PNP levels of 4.3 ppm. Absenteeism in this group was 71%.

73-2420. Wolfe, H. R.; Armstrong, J. F.; Staiff, D. C.; Comer, S. W. (Wenatchee Res. Sta., PPL, Off. Res. Monitoring, EPA, Wenatchee, WA 98801). **The use of protective clothing and equipment for prevention of exposure to pesticides.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers, Washington, 1972, pp. 155-165.* (25 references)

Workers operating air blast spray machines applying parathion to fruit orchards in central Washington rarely wore respirators except when spraying compounds as toxic as parathion. With this material 24% wore respirators in warm weather and 30% wore them in cooler weather; with more toxic compounds respirators were worn in practically every instance. Respirators were not always properly maintained by spraymen. Men operating dusters or formulating seemed more careful. Ground applicators rarely wore goggles, but at least half wore protective hats. During the warmer months less protection was worn on the upper trunk and arms. Waterproof boots and gloves (unlined) are recommended but often not worn at most critical times. Without protective long sleeves, hats, gloves etc., the greatest exposure potential was on the forearm. Data shows that exposure could be reduced considerably with protective clothing.

73-2421. Bailey, J. B. (Univ. California, Agr. Extension Service, Davis, CA). **Basic rules for safe handling of pesticides.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers, Washington, 1972, pp. 167-168.*

Safety in handling pesticides should begin with close contact between user and physician on types of pesticides used and baseline tests for ChE. Warnings and precautions should be noted before containers are opened, and protective equipment, wash water, and first aid procedures should be on hand. Pesticides should be stored in original containers in locked, dry storage areas. Containers which cannot be burned should be buried where contamination of crops or drainage will not be a problem, or in a dump which is permitted to accept pesticide containers. Important first aid measures in case of poisoning include immediate removal of the victim from exposure and induction of vomiting (except in the case of petroleum products).

73-2422. Vilardo, F. J. (Univ. N. Carolina, Highway Safety Res. Cent., Chapel Hill, NC). **The acceptance of safety programs.** *IN: Proceedings of the National Conference on Protective Clothing and Safety Equipment for Pesticide Workers, Washington, 1972, pp. 103-111.* (10 references)

Various social factors have been correlated with acceptance of new agricultural methods or products although those who accept new ideas readily make up a certain percentage of the general population. These findings can be used to determine the success of a program, but prediction of success of a safety program cannot depend on such a costly method as intensive questioning. An index of safety predictability could be developed from seven community and organizational factors which are: median family income; unemployment; percent of growth; ratio of managers, proprietors, and officials to total employees; presence of an organizational handbook; changes in by-laws; and number of board meetings.

73-2423. Gonzales-F., M.; Garcia-L., H.; Valenzuela-D., B.; Rosenkrans, A.; Sandoval-O., H. (Hospital de Urgencia Dr. Alejandro del Rio, Santiago, Chile). **Intoxicaciones agudas. Diagnostico y tratamiento (Analisis de 110 casos in una Unidad de Tratamiento Intensivo). [Acute poisonings. Diagnosis and treatment. Analysis of 110 cases in an Intensive Care Unit.]** *Rev. Med. Chile 98(8): 501-506; 1970.* (21 references) (Spanish)

Treatment of poisoning due to barbiturates, tranquilizers, and pesticides is outlined. Poison ingestion was massive with suicidal intent in most cases, but occupational poisonings in farm workers were also seen. All the pesticide poisonings involved organophosphates, which inhibit cholinesterase, resulting in acetylcholine accumulation, and which can be fatal due to cardiorespiratory depression. The most effective treatment is atropine injection. The atropine neutralizes only such toxic effects of acetylcholine as the occurrence of bradycardia, bronchial and salivary hypersecretion, and gastrointestional disturbances, but does not act on cerebral poisoning or neuromuscular blockade. Less specific antidotes include oximes such as 2-PAM and Contrathion, which restore acetylcholinesterase, but which are not as rapidly effective as atropine. Cases treated with 2-PAM showed no side effects. In cases of convulsions due to poisoning, barbiturates must not be used for treatment. Succinylcholine may be useful if the patient is connected to a mechanical respirator.

73-2424. Bakir, F.; Damluji, S. F.; Amin-Zaki, L.; Murtadha, M.; Khalidi, A.; Al-Rawi, N. Y.; Tikriti, S.; Dhahir, H. I.; Clarkson, T. W.; Smith, J. C.; Doherty, R. A. (Univ. Baghdad, Baghdad, Iraq). **Methylmercury poisoning in Iraq.** *Science 181(4096): 230-241; 1973.* (19 references)

Studies of the epidemic of methylmercury poisoning which occurred in Iraq in 1972 as a result of the use of treated seed wheat and barley in homemade bread yielded information not readily obtainable from animal experiments. Of the 6530 cases admitted to hospitals, 459 had fatal outcomes. The correlation coefficient between the amount of mercury ingested from the bread and the concentration of mercury in the blood (mostly organic mercury) was 0.85 for adults and 0.89 for teenagers. No correlation was observed, however, between the total admissions per province and the amount of treated grain distributed in each province. For future epidemiological studies analysis of hair samples gives a more accurate recapitulation of exposure than blood analysis. Considerable variation in response of individuals was noted with the use of mercury binding agents, but thiol resin and penicillamines did reduce blood levels of mercury and would probably have been more effective if therapy had been continuous. Symptoms of poisoning began to occur an average of 16 to 38 days after cessation of consumption of contaminated bread. Infants were exposed to mercury in the mother's milk, in which concentrations averaged about 3% of those in the blood. Factors contributing to the consumption of the treated seed included: delivery of the seed after some farmers had already planted; delay before onset of symptoms in animals and humans; the fact that the indicator dye could be washed off without removing the fungicide; and use of an unfamiliar language for warning labels.

73-2425. Matsueda, S.; Mikami, M.; Ohtaki, Y.; Kudo, N. (Hirosaki Univ., Hirosaki, Aomori Pref., Japan). **[Interrelations between blood glutathione and cholinesterase activity in methyl parathion poisoning.]** *Seikagaku (J. Jap. Biochem. Soc.) 44(7): 299-302; 1972.* (22 references) (Japanese)

The antidotal effect of GSH (reduced glutathione) was examined by administration to a patient poisoned by methyl parathion. A restoration of cholinesterase activity to its normal level was noted. To clarify the interactions between GSH and ChE the quantitative relationships of ChE and GSH, fluctuations of plasma ChE activity of poisoned patients in relation to GSH depletion, and the relationship between GSH in blood cells and normal ChE activity were examined. A parallel between plasma ChE activity and the total GSH level was noted, but the relationship was not clear. The rate of incorporation of GSH into blood cells is rather low and could not be measured in the in vivo experiment. In vitro admixture of GSH with ChE did not restore ChE activity. It is known that material which does not ordinarily pass through the erythrocyte membrane can affect the cell function significantly if it should pass through even in the smallest quantity. When GSH is added to the extracellular fluid and a high concentration of GSH saturates the cell, it is conceivable that the GSH concentration in the erythrocyte could rise considerably above the physiological GSH concentration. However, this could not be confirmed. Further studies will be conducted on the GSH-ChE relationship.

73-2426. Gaultier, M.; Bescol-Liversac, J.; Frejaville, J. P.; Leclerc, J. P.; Guillam, C.; Rodde, M. T. (L'Hopital Lariboisiere, Paris, France). **Etude anatomo-clinique et experimental de l'intoxication par le paraquat. Lesions ultrastructurales. [Anatomic-clinical and experimental study of paraquat poisoning. Ultrastructural lesions.]** *Sem. Hop. (Paris) 49(27): 1972-1987; 1973.* (20 references) (French)

Ultrastructural lesions due to paraquat poisoning are described based on two fatal cases of accidental ingestion of paraquat and acute poisoning tests performed on Wistar rats. Pulmonary lesions developed rapidly after the appearance of such symptoms as emesis and anuria. The vital capacity and hemoglobin oxygen content were sharply reduced; gradual asphyxiation occurred. Symptoms resembled a combination of emphysema, atelectasis, and especially hypertrophic reticular pneumonia with pronounced congestion and

septal sclerosis. Involvement of the pulmonary epithelium and particularly of the granular pneumocytes, with inflammatory reaction and inexorable progress towards fibrosis were observed. Desquamation of membrane pneumocytes and pronounced interstitial edema were detected in Wistar rats two days after i.p. administration of 25 mg paraquat per kg body weight.

73-2427. Uono, M. (Dept. of Neurol., Tokyo Metropolitan Hospital, Fuchu, Tokyo, Japan). **[Organophosphorus poisoning.]** *Shinkei Kenkyu No Shimpo (Adv. Neurol. Sci.) 16(5): 892-901; 1972.* (25 references) (Japanese)

Neurological damage caused by organophosphorus poisoning, the clinical course, pathological observations, treatment, case studies, and rabbit experiments are reviewed. Muscarinic symptoms caused by acute organophosphate poisoning include constriction of the retina, salivation, abdominal pain, polyuria, and incontinence. When smaller amounts of chemical are given, the symptoms become chronic and some of these symptoms fail to appear. Chronic central nervous system symptoms include generalized fatigue, loss of consciousness, fever, and headache; increases in leukocyte count and urine sugar level are observed. These are considered to be related to anticholinesterase effects. Generally, anti-ChE compounds cause low blood pressure, but in serious cases of organophosphate poisoning, the blood pressure increases. One consistent symptom of chronic poisoning is eye damage. The author's examination of Osaka-Moriguchi area patients revealed that 169 out of 262 patients had chronic organophosphate poisoning; 133 were less than 12 years old and 36 were adults. In addition to the usual symptoms, spinal, central, and peripheral nerve damage, weight loss, swelling of tonsils, unbalanced appetite, and excessive thirst occurred. Gray spots on teeth and swelling of the thyroid also seemed to be related to the poisoning. Most cases had low plasma ChE, an elevated urine PNP, and increases in inorganic phosphorus and alkaline phosphatase. In the Nagano-Saku area out of 151 cases diagnosed as eye damage caused by organophosphate pesticides, 100 cases were in children less than 12 years old, and 51 were adults. Several cases of pesticide poisoning (parathion, Sumithion (fenitrothion), diazinon, DDVP (dichlorvos)) are described, and eye damage in cows, dogs, and horses, as well as experimental findings in rabbits are reported.

See also

73-2319	73-2321	73-2331	73-2382	73-2435	73-2491	73-2490
73-2320	73-2323	73-2332	73-2383	73-2456		

73-2428. Kolberg, J.; Helgeland, K.; Jonsen, J.; Tjeltveit, O. (Dept. Microbiol., Dental Fac., Univ. Oslo, Oslo, Norway). **Effect of a phenoxy herbicide on mammalian cell cultures, a time-lapse cinemicrographic study.** *Acta Pharmacol. Toxicol. (Suppl.) 28: 57; 1970.*

The growth of mouse fibroblasts in monolayer cultures was inhibited by 2,4-D. A transient accumulation of lipid containing vacuoles was observed in the cytoplasm. Growth resumed when cells were placed in control medium. Cell division was not seen during the 33-hr exposure period with a concentration of 500 μg/ml. The herbicide did not appear to affect pinocytosis or the undulating activity of cell membranes.

73-2429. Froeslie, A. (Nat. Vet. Inst., Oslo, Norway). **Methaemoglobin formation in vitro by 6-amino metabolites of DNOC and DNBP.** *Acta Pharmacol. Toxicol. 29(5-6): 490-498; 1971.* (13 references)

DNOC, DNBP, their 6-amino-, and their 6-acetamido derivatives were tested for a methemoglobin-forming effect on erythrocytes from cows, horses, dogs, pigs, and hens. At concentrations of 3 and $5 \times 10^{-4} M$ only 6-ANOC and 6-ANBP were active, the former having more of an effect in bovine erythrocytes and the latter in porcine and equine erythrocytes. The response was approximately the same for the two compounds in dog and in man. The greatest effect was observed with canine erythrocytes while only minor differences were noted between the responses in other species. The results suggest that differential formation of the aminophenols and the rate of acetylation of these compounds is responsible for the pronounced methemoglobin formation in vivo in cows, rather than differences in susceptibility of erythrocytes.

73-2430. Jakobson, I.; Yllner, S. (Nat. Inst. Occup. Health, Stockholm, Sweden). **Metabolism of ^{14}C-pentachlorophenol in the mouse.** *Acta Pharmacol. Toxicol. 29(5-6): 513-524; 1971.* (15 references)

About one-half of the radioactivity administered intraperitoneally to mice as ^{14}C-pentachlorophenol (PCP) was excreted within 24 hours, primarily in the urine with less than 0.05% found in expired air. The gallbladder and its contents, the liver, and the intestine contained the highest activity of the tissues examined. The animals contained a total of 3% of the activity one week after administration. In whole-body autoradiograms of the mice four hours after subcutaneous injection of ^{14}C-PCP the fundus wall of the stomach and the contents of stomach and intestines contained the highest activities. After 20 hours a considerable amount was observed in the liver. Urinary activity in the first 24 hours was mainly due to PCP, free and conjugated, and probably tetrachlorohydroquinone.

73-2431. Wolburg, I. (Author address not given). **Das Elektroenzephalogramm (EEG) von Kaninchen bei chronischer Intoxikation mit Hexachlorcyclohexan (HCH) beziehungsweise Schwefelkohlenstoff (CS2). [The EEG of rabbits chronically poisoned with BHC and carbon disulfide.]** *Activ. Nerv. Super. 15(1): 12-13; 1973.* (5 references) (German)

Two-year-old rabbits were gradually poisoned with increasing doses of BHC during a 14-week-experiment. Effects were monitored by electroencephalography. When doses administered did not cause convulsions, animal behavior was normal. Atypical intervals in the EEG increased from an average of 0.2% to 3% as a result of BHC poisoning. The percentage of atypical intervals reached 4% under light flash stimulation the first two months after poisoning. Waves with 1 to 4 W/sec and 25-50 μV were frequently observed.

73-2432. Lewis, M. F.; Mertens, H. W.; Steen, J. A. (Civil Aeromed. Inst., Fed. Aviation Admin., Oklahoma City, OK 73125). **Behavioral changes from chronic exposure to pesticides used in aerial application: effects of phosdrin on the performance of monkeys and pigeons on variable interval reinforcement schedules.** *Aerospace Med. 44: 290-293; 1973.* (8 references)

When animals were treated with mevinphos in graded doses given intramuscularly every 4 or more days, a dose-related decrease in response rate was observed in pigeons (key peck) and monkeys (lever press) in operant behavior chambers on variable-interval schedules of reinforcement. A lowered response rate was observed at doses below those at which external symptoms of poisoning occurred. Tremor, salivation, and lack of coordination were evident in monkeys at doses > 0.20 mg/kg. In pigeons rapid, excessive blinking, and pennerection were observed at 0.35 mg/kg. The results suggest the need for additional research, pertinent to the safety of cropduster pilots, concerning the behavioral actions of pesticides.

73-2433. Gel'tser, Yu. G.; Geptner, V. A.; Stonov, L. D. (Chashniko Training and Exp. Agrobiol. Sta., M. V. Lomonosov State Univ., USSR). **O vliyanni gerbitsidov na mikroorganizmy ila i vody kollektorov chardzhouskogo oazisa Turkmenskoy SSR. [Effect of herbicides on the sludge and water microorganisms in the collectors of the Chardzhou oasis in the Turkmenian SSR.]** *Agrokhimiya 6: 119-123; 1972.* (14 references) (Russian)

The effect of diuron and monuron on sludge and water microorganisms in the collectors of the Chardzhou oasis in the Turkmenian SSR and the bactericidal action of diuron on *Mesentericus, Pseudomonas, Azotobacter, Streptococcus* and *Cryptococcus* were studied in vivo and in vitro. Diuron, applied in collectors at 60 kg/ha in 10% solution exerted maximum bactericidal action during the first days after application after which the bacteria count in water grew and finally stabilized. Diuron inhibited the growth and development of *Actinomycetes* and cellulolytic bacteria, but it had no notice-

able effect on the sporifera count. In vitro tests revealed the most powerful bactericidal action with a 10% solution of diuron. Diuron in 0.5% solution did not inhibit microorganisms except *Pseudomonas* and *Azotobacter*.

73-2434. Pel'tser, A. S. (Timiryazev Agr. Acad., Moscow, USSR). **Kinetika razlozheniya C14-mocheviny v pochve v zavisimosti ot vlazhnosti pochvy, vneseniya yadokhimikatov, izvestkovaniya i velichiny pH pochvy. [Kinetics of the decomposition in the soil of C14-labeled urea as a function of the soil moisture content, the introduction of pesticides and lime, and soil pH.]** *Agrokhimiya 10: 32-37; 1972.* (4 references) (Russian)

The effects of soil moisture content, soil pH, lime, atrazine, trichlorfon, mercury chloride, copper nitrate, and silver nitrate were studied on the rate of decomposition of C14-labeled urea in a laboratory test. The presence of atrazine, trichlorfon, copper nitrate, silver nitrate, and mercury chloride in the soil reduced the decomposition rate of urea. Two hundred mg of atrazine per kg of soil increased the time required (from 55 to 75 hours) for the decomposition of 10 mg of urea per 100 g of soil with 60% moisture content, a temperature of 18 C, and a pH value of 6.7. An equal dose of trichlorfon inhibited the total decomposition of urea in soil after 36 hours, by which time 80% of the total urea introduced was decomposed.

73-2435. Spiridonov, Yu. Ya.; Spiridonova, G. S. (Moscow Region, All-Union Sci. Res. Inst. Phytopathol., Moscow, USSR). **Vliyaniye mnogoletnego primeneniya simm. triazinov na biologicheskuyu aktivnost' pochvy. [The effect of using symmetrical triazines for many years on the biological activity of soil.]** *Agrokhimiya 3: 122-131; 1973.* (3 references) (Russian)

Extensive use of pesticides for 5-10 years was studied in field and laboratory tests. Of special interest were the effects of 5, 10, and 20 kg/ha doses of simazine, atrazine, and prometryne on the microbiological and biochemical properties of moist farm and meadow soils from subtropical areas of western Georgia (USSR). No essential changes in the density and activity of the soil microflora resulting from symmetrical triazines occurred. The activity of the soil microorganisms was determined by weed density rather than duration of systemic pesticide use. Simazine applied at 5 and 10 kg/ha for five years increased the catalase activity and temporarily reduced the activity of dehydrogenases and proteases in the soil. The herbicides investigated inhibited the activity of dehydrogenases and proteolytic enzymes during the first 40-70 days after their application although the activities later exceeded the ones in the controls. Without higher plants the enzymatic activites in the soil were not modified even after addition of 2-8 kg/ha doses of atrazine, simazine, and prometryne for 10 years.

73-2436. Krause, W.; Homola, S. (Author address not given). **Beeinflussung der Spermiogenese durch DDVP (Dichlorvos). [Effect of DDVP (dichlorvos) on spermiogenesis.]** *Arch. Dermatol. Forsch. 244: 439-441; 1972.* (German)

The effect of dichlorvos on spermiogenesis was studied in NMRI/Han line albino mice. The animals were administered single 40 mg/kg doses of dichlorvos through stomach tube or daily oral 10 mg/kg doses for 18 days. Reduction and vacuolization of the seminal epithelium, spermatids, and spermatocytes, and degenerating meioses in metaphase were found in the group poisoned with a single dose of dichlorvos. Similar, though less pronounced, changes were evident in the chronically poisoned animals. Although the Im- and B-spermatogonia were damaged, Leydig's cells were unaffected.

73-2437. Ippen, H.; Aust, D. (Univ.-Hautklinik Duesseldorf, Duesseldorf, Germany). **Klinisch-experimentelle Untersuchungen zur Entstehung der Porphyrien. I. Allgemeine und tierexperimentelle Modellversuche. [Studies on porphyria cutanea tarda: experimental models.]** *Arch. Dermatol. Forsch. 245: 110-124; 1972.* (22 references) (German)

The mechanism of induction of experimental porphyria cutanea tarda was investigated in rats and mice using hexachlorobenzene (HCB). Male Wistar rats were the most suitable animal, and the so-called latent HCB porphyria, produced by feeding 0.2% HCB on three successive days per week, yielded the most information. HCB at this level also slightly increased porphyrin excretion for a considerable length of time. Two other degrees of experimental porphyria were produced by different dosage schedules. Other factors caused more severe alterations in urine porphyrin levels.

73-2438. Ippen, H.; Aust, D.; Goerz, G. (Univ. Hautklin., Duesseldorf, Germany). **Klinisch-experimentelle Untersuchungen zur Entstehung der Porphyrien. III. Wirkung einiger Steroid-Hormone auf die "latente Hexachlorbenzol-Porphyrie" der Ratte. [Clinical and experimental studies on the development of porphyria. III. Effects of some steroid hormones on latent hexachlorobenzene porphyria in the rat.]** *Arch. Dermatol. Forsch. 245(4): 305-317; 1972.* (46 references) (German)

The effects of estrogen, gestagen, and androgen administration on porphyrin metabolism were studied in normal rats and rats with slight liver damage ("latent porphyria") produced by addition of 0.2% hexachlorobenzene to their diet for three days a week. Administration of ca. 5 mg estradiol alone or in combination with ca. 150 mg 17α-hydroxyprogesterone or ca. 50 mg testosterone to normal rats failed to affect or slightly decreased the excretion of porphyrins in the urine. Administration of these hormones to latent porphyric rats provoked severe porphyria. Repeated injection of

the gestagen gestonoron produced a slight increase in porphyrin excretion in the first months, followed by renormalization in healthy rats, and similar results in porphyric rats. Repeated injection of testosterone propionate in normal rats had no effect, whereas latent porphyric rats showed a transient increase in porphyrin excretion similar to that in the gestagen-treated rats. The fundamental changes in porphyrin metabolism produced by combined hormone-hexachlorobenzene administration contrast with the results of chick embryo liver cell cultures: the porphyrinogenic effect in the latter case is marked in the case of estradiol and practically absent with gestagens and testosterone.

73-2439. Fang, S. C. (Dept Agr. Chem., Oregon State Univ., Corvallis, OR 97331). **Uptake and biotransformation of phenylmercuric acetate by aquatic organisms.** *Arch. Environ. Contam. Toxicol. 1(1): 18-26; 1973.* (5 references)

Uptake of phenylmercuric acetate (PMA) in two species of aquatic plants and two species of aquatic animals was related to the time of exposure and the concentration of the mercury-labeled PMA. Accumulation generally reached a maximum in two or three days and a gradual decrease followed. At $5 \times 10^{-8} M$ PMA maximum accumulations of 20 and 15 nmol/g fresh tissue were obtained in the elodea and the coontail while 4.5 and 2 nmol/g accumulated in the guppy and the snail. The biological half-life for mercury-203 in these organisms ranged from 43 to 58 days. A small increase in the amount of ethyl mercuric chloride found in each organism occurred after PMA exposure.

73-2440. Earl, J. W.; Kennedy, I. R. (Dept. Agr. Chem., Univ. Sydney, Sydney, N. S. W. 2006, Australia). **Pretreatment effects on the rates of aldrin metabolism in pea plants (*Pisum sativum*).** *Aust. J. Biol. Sci. 26(2): 341-347; 1973.* (8 references)

Levels of aldrin in roots of pea plants exposed to the pesticide from days 0, 3, 5, and 7 after planting reached a maximum between 6 and 7 days after initial exposure. The decrease in aldrin level which followed was far greater than the rate of appearance of dieldrin, suggesting the presence of more than one metabolic pathway. Conversion of aldrin to dieldrin, demonstrated in the microsomal fraction of pea and lupin roots, was enhanced in samples from plants grown in the presence of phenobarbital. The rate of dieldrin formation was reduced in roots of aniline pretreated plants. The production of dieldrin by root tissue extracts did not differ in plants grown with and without aldrin. The decline of aldrin was only slightly greater than the formation of dieldrin in control peas. Aldrin degradation was about 20-fold greater than dieldrin formation when plants were grown in the presence of aldrin or dieldrin. Retention of the pesticide in peas was much lower than in barley and clover, and this difference was attributed to differential rates of metabolism or inductive effects. The amount of aldrin plus dieldrin was relatively low in the tops of pea plants.

73-2441. Buswell, J. A. (Biol. Lab., Univ. Kent, Canterbury, Kent, England). **Metabolism of piperonylate by *Pseudomonas fluorescens*.** *Biochem. J. 130(1): 32P-33P; 1972.* (4 references)

Cell-free extracts of *Pseudomonas fluorescens* grown on anisate as the sole carbon source metabolized piperonylate and the methoxylated compound in the presence of NADPH. The data shows that the reaction proceeded via the hydroxylation of the methylene carbon and hydrolysis of the hydroxymethlenedioxy derivative to formate and the dihydroxy acid. Protocatechuate, an intermediate in the breakdown pathway, was further metabolized to 3-oxoadipate. Thermal inactivation and inhibition studies indicate that the piperonylate mono-oxygenase and 4-*O*-demethylase were the same enzyme.

73-2442. Smirnov, A. A.; Lobachev, V. S.; Denisova, A. V. (Dept. Zool. Vertebr., M. V. Lomonosov Moscow State Univ., Moscow, USSR). **Vliyaniye sevina na reproduktivnuyu sposobnost' bol'shoy peschanki pri obrabotke rastitelnosti na yeye koloniyakh. [Effect of carbaryl on the reproductive capacity of *Rhombomys opimus* Licht. in carbaryl-treated areas.]** *Biol. Nauki. 3: 29-33; 1971.* (14 references) (Russian)

The vegetation around colonies of ground squirrels (*Rhombomys opimus* Licht.) was treated with carbaryl at 0.5 g/m^2 in a radius of 15 m to study the effect of carbaryl on the reproduction of this species. The carbaryl concentrations in plants around dens and in food stored in dens were above 0.03 mg/kg and above 0.02 mg/kg four months after carbaryl application. Considerable rarefaction of the populations as compared to untreated colonies was determined. The percentage of lactating females was 5.9% against a control value of 31.6%, and 41.2% of all females were inactive in mid-May, while the corresponding percentage for untreated colonies was 28.9%. The rates of fetal resorption were 41.9% in the test group and 1.08% in the control group. The average number of embryos was 6 against 7.4 in the control group. Carbaryl nevertheless seems promising for control of fleas on ground squirrels in endemic plague areas due to its lack of cumulative tendency and its compatibility with other chemicals.

73-2443. Cotillo-Z., P.; Huaman, B.; Tamashiro, J. (Dept. Farmacol., U.N.M.S.M., Peru). **Actividad farmacologica del 2-isopropoxifenil-*N*-metilcarbamato (Baygon). [Pharmacological activity of 2-isopropoxyphenyl-*N*-methylcarbamate (Baygon).]** *Bol. Soc. Quim. Peru 38(2): 79-90; 1972.* (18 references) (Spanish)

The pharmacologic activity of Baygon (propoxur) was examined and compared with that of other types of

cholinesterase inhibitors. Propoxur, administered at 0.4-0.8 mg/kg to urethane-anesthetized rats, potentiated the hypotensive effects of intravenously administered acetylcholine chloride. Blood pressure reductions of 10-15% were found. When administered alone, propoxur produced immediate arterial hypotension followed by prolonged hypertension. Both propoxur and neostigmine enhanced the contractions produced in isolated rat ileum by addition of acetylcholine to the incubation bath. Propoxur and neostigmine were approximately equal in ability to enhance intestinal contractions although neostigmine is 100 times more powerful as a cholinesterase inhibitor. The differences in activity between neostigmine and propoxur can presumably be explained by differences in structures between the two compounds. The two active centers of neostigmine permit firm, rapid, and slowly hydrolyzing attachment at an anionic and an esteratic site on the cholinesterase molecule, whereas propoxur, lacking the quaternary nitrogen, can only become attached by its electrophilic carbon to the esteratic site.

73-2444. Nishiuchi, Y.; Yoshida, K. (Agr. Chem. Insp. Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[On the effects of several pesticides on snails in fresh water.]** *Bull. Agr. Chem. Insp. Sta. 12: 86-92; 1972.* (3 references) (Japanese)

Toxicities (TLm, 48 hr, 22°C) of 109 pesticides (50 insecticides, 35 fungicides, and 24 herbicides) to four kinds of freshwater snails, *Indoplanorbis exustus, Semisulcospira libertina, Cipangopaludina malleata* and *Physa acuta* and carp were determined in aqueous solutions or aqueous acetonic solution using tap-water treated with active charcoal at 22.0 C. The susceptibility of *C. malleata* to lindane, fenitrothion, carbaryl, and Na-PCP was higher in young snails than in old ones. The most toxic pesticides to all species were trichlorfon, bromoxynil, copper-containing pesticides, organomercury pesticides, and Na-PCP. A definite correlation of susceptibility was found between *S. libertina* and *I. exustus, C. malleata* and *I. exustus*, and *P. acuta* and *I. exustus*; however, no such correlation was found between carp and *I. exustus*. Symptoms of poisoning in all snails included anomalous stretching or contracting of the body. Stretching was most marked on *S. libertina* especially when treated with organophosphorus and *N*-methylcarbamate insecticides. Contracting was noticed with rotenone, cartap, tetrachloroisophthalonitrile, and cupric hydroxide. Snails which developed these phenomena almost always died after 3-4 days in the test water. Snails which did not develop these symptoms within 24-48 hr did not develop the symptoms when treated for longer periods with lower concentrations of the same pesticide.

73-2445. Yoshida, K.; Nishiuchi, Y. (Agr. Chem. Insp. Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[Toxicity of pesticides to some aquatic organisms.]** *Bull. Agr. Chem. Insp. Sta. 12: 122-128; 1972.* (Japanese)

Toxicities of 332 kinds of registered pesticides (including 115 insecticides, 114 fungicides or bactericides, and 94 herbicides) were determined to the following fresh water organisms: carp, Japanese gold fish, killifish (scarlet), loach, toad tadpole, American crayfish, two kinds of water flea, a kind of crab, and short-necked clam. The toxicity is presented in TLm values using 48 hr for fish and tadpole, 3 hr for water flea, 72 hr for crayfish, and 96 hr for short-necked clam. The determination temperature was 25°C except for tadpoles which was 17.5°C. The TLm values are tabulated alphabetically by the name of the pesticide regardless of its biological activities.

73-2446. Soedergren, A.; Svensson, B. (Zool. Inst., Dept. of Animal Ecol., Univ. Lund, Lund, Sweden). **Uptake and accumulation of DDT and PCB by *Ephemera danica* (Ephemeroptera) in continuous-flow systems.** *Bull. Environ. Contam. Toxicol. 9(6): 345-350; 1973.* (13 references)

Mayfly nymphs, collected from a stream in southern Sweden, were placed in a continuous-flow chamber with water at 14°C or 8°C containing *p,p'*-DDT or PCB dissolved in ethanol. The animals were given no food during the 9-day test period, so that uptake of test substances occurred exclusively via gills and integument. The organochlorine concentrations in the air bubbled through the chamber were determined so that a complete budget calculation for the substances within the system could be performed. Uptake and accumulation of both DDT and PCB by *E. danica* followed apparent first-order kinetics, and reached an apparent equilibrium level after 4-5 days of exposure. The *p,p'*-DDT in the system was rapidly metabolized by the animals, primarily to *p,p'*-DDE, while occasionally small amounts of *p,p'*-DDD (TDE) were detected. The DDE/DDT ratio was 1.0 on the first day of exposure, but reached 3.2 on the second day, and remained relatively constant thereafter. PCB apparently was not degraded.

73-2447. Muller, H. D.; Lockman, D. C. (Extension Poultry Sci. Dept., Univ. Georgia, Athens, GA 30601). **The influence of dieldrin on tibial bone calcium deposition in domestic chicks.** *Bull. Environ. Contam. Toxicol. 9(6): 351-355; 1973.* (16 references)

No significant differences in percentages of calcium in fat-free, dry tibial bones of Single Comb White Leghorn and broiler chicks were found between controls and dieldrin-treated birds at 35 days of age. Dieldrin treatments consisted of 5 or 10 mg/kg of dieldrin incorporated in the feed for four weeks or introduction of gelatin capsules at seven days of age for a dosage of 5 or 10 mg/kg of body weight. Dietary calcium levels were marginal and produced lower than normal calcium percentages. Calcium metabolism was evidently not altered

in young growing chicks when subtoxic levels of dieldrin were ingested.

73-2448. Cook, R. M. (Dept. Dairy Sci., Michigan State Univ., E. Lansing, MI 48823). **Effects of inositol, diphenylhydantoin and phenobarbital on HEOD storage in rat adipose tissue.** *Bull. Environ. Contam. Toxicol. 9(6): 370-375; 1973.* (6 references)

Phenobarbital (500 ppm), but not diphenylhydantoin (500 ppm) or inositol (1000 ppm), decreased the concentration of dieldrin (HEOD) accumulated in rat adipose tissue when fed for two weeks after withdrawal of dieldrin-containing feed. Phenobarbital and diphenylhydantoin, fed simultaneously with dieldrin for two weeks and then two weeks after withdrawal of dieldrin, prevented the normal accumulation of dieldrin in the fat. Diphenylhydantoin and inositol did reduce the dieldrin level to about half that of the control level when fed for four weeks after withdrawal of the insecticide. Inositol apparently had no effect on adipose tissue weights and did not induce microsomal aminopyrine demethylase. It is possible that inositol provides a source of glucuronic acid that can stimulate the synthesis of a glucuronide from a dieldrin metabolite. Diphenylhydantoin probably induces the activity of dieldrin-metabolizing enyzmes although only a minor effect was observed with aminopyrine demethylase.

73-2449. Traiger, G. J.; Plaa, G. L. (Dept. Pharmacol., Fac. Med., Univ. Montreal, Montreal, Quebec, Canada). **Effect of aminotriazole on isopropanol- and acetone-induced potentiation of CCl_4 hepatotoxicity.** *Can. J. Physiol. 51(4): 291-296; 1973.* (17 references)

The effect of aminotriazole (amitrole) on isopropanol- and acetone-induced potentiation of CCl_4 hepatotoxicity and the in vivo metabolism of isopropanol and acetone was studied in rats. Aminotriazole plus isopropanol, 18 hr prior to a challenging dose of CCl_4, reduced the isopropanol-enhanced response of CCl_4; serum glutamic-pyruvic transaminase (SGPT) activities were less than those found for isopropanol plus CCl_4. Hepatic triglyceride content also reflected reduced hepatotoxicity. Aminotriazole pretreatment did not produce any change in the rate of isopropanol elimination nor was the rise and subsequent decline in the blood concentrations of the derived acetone altered. An 18 hr pretreatment with acetone enhanced CCl_4 hepatotoxicity. Aminotriazole, 15 min prior to acetone, diminished the enhanced response of CCl_4 to acetone (reduced SGPT activities and hepatic triglyceride content). Aminotriazole had no effect on acetone elimination from the blood 1, 4, and 8 hr after the oral administration of acetone. Aniline hydroxylase activity was increased 17 hr after the administration of isopropanol. The data are consistent with the hypothesis that isopropanol augments CCl_4 hepatotoxicity by affecting the microsomal drug-metabolizing enzyme system. (Author abstract by permission)

73-2450. Conney, A. H.; Levin, W.; Jacobson, M.; Kuntzman, R. (Dept. Biochem. Drug Metab., Hoffmann-La Roche Inc., Nutley, NJ). **Effects of drugs and environmental chemicals on steroid metabolism.** *Clin. Pharmacol. Ther. Part II 14(4): 727-741; 1973.* (79 references)

Results of a number of animal experiments have indicated that drugs and environmental chemicals which stimulate or inhibit hepatic drug metabolism also alter the hydroxylation of steroid hormones. Pesticides which stimulate microsomal hydroxylation of drugs and steroids include DDT, chlordane, and dieldrin. Altered metabolism and action of steroids have been demonstrated in vivo using various chemicals. At least one of the above pesticides inhibited the uterotropic action of estrogens and decreased the anesthetic action of progesterone. Occupational exposure of humans to DDT or treatment with *o,p'*-DDD (TDE) markedly stimulated the metabolism of cortisol to 6 β-hydroxycortisol. Inhibition of microsomal hydroxylation is associated with carbon tetrachloride, chlorthion, malathion, parathion, and pesticide synergists. Inhibitors tend to enhance the uterotropic action of estrogens. Since the human fetus and placenta and the pregnant woman hydroxylate steroids in many positions not otherwise altered in the adult, the effects of drugs, pesticides, and other environmental chemicals during pregnancy should be investigated.

73-2451. Singh, J. M. (Dept. of Pharmacol., Xavier Univ., New Orleans, LA). **Decreased performance behavior with carbaryl—an indication of clinical toxicity.** *Clin. Toxicol. 6(1): 97-108; 1973.* (7 references)

The subchronic administration of carbaryl for 14 days had no effect on the performance behavior of rats in the activity wheel cages (PBAWC). The acute administration of the pesticide carbaryl and atropine sulfate significantly decreased the PBAWC of normal (nontreated) rats. When carbaryl was administered to atropine sulfate-treated rats, the drugs did not produce additive effects or interaction by decreasing the PBAWC. Caffeine monohydrate, which is a CNS stimulant, significantly increased the PBAWC. This increase in PBAWC was antagonized by carbaryl and this antagonism was reversed by atropine sulfate. It is suggested from our results that decreased PBAWC should be regarded as an important symptom in determining the clinical psychotoxicological toxicity of a compound. (Author abstract by permission)

73-2452. Rappolt, R. T. (4141 Geary No. 403, San Francisco, CA). **Use of oral DDT in three human barbiturate intoxications: hepatic enzyme induction by reciprocal detoxicants.** *Clin. Toxicol. 6(2): 147-151; 1973.* (18 references)

Three female patients with moderate to massive (3000 mg phenobarbital) barbiturate ingestions appeared

to improve following oral administration of 5 g technical grade DDT in peanut oil. Although too short a time elapsed between their recovery for true reciprocal detoxicants to induce hepatic enzymes, this plus speculation that the CNS arousal capability of DDT back-titrated their depressed state is discussed along with the concept of the autogenous detoxicant. (Author abstract by permission)

73-2453. Meiniel, R. (Lab. Biol. Anim., Aubiere, France). **Activite acetylcholinesterasique surrenalienne chez l'embryon de poulet age, dans les conditions normales et apres intoxication par le parathion (E. 605). [Cholinesterase activity in the adrenal gland of 16 day old chick embryos, in normal condition and after parathion (E. 605) intoxication.]** *C. R. Soc. Biol. 166(10): 1293-1296; 1972.* (10 references) (French)

The effect of incubation with 5 mg of parathion for five hours was studied on the acetylcholinesterase activity of 16 days' old chicken embryos by the Koelle-Gerebtzoff method. Very low acetylcholinesterase activity after a minimum incubation time of three hours was detected in the periadrenal ganglia although no residual activity in the intraparenchymatous fibers was evident. The anticholinesterase effect of parathion may lead to accumulation in the adrenal cholinergic nerves of non-hydrolyzed acetylcholine. Parathion had specific anticholinesterase effect and failed to affect the 3-beta-hydroxysteroid dehydrogenase activity.

73-2454. Graff, G. L. A.; Gueuning, C.; Vanderkelen, B. (Lab. Chim. Pathol., Fac. Med., Brussels, Belgium). **Influence de l'acide 2,4-dichlorophenoxyacetique (2,4-D), un agent myotonisant, sur le metabolisme des phosphates acidosolubles des muscles squelettiques du Rat. [The effect of 2,4-dichlorophenoxyacetic acid (2,4-D), a myotonic agent, on the metabolism of acid soluble phosphates in the rat skeletal muscles.]** *C. R. Soc. Biol. 166(11): 1565-1568; 1972.* (15 references) (French)

The effect of 2,4-D was studied on the metabolism of acid-soluble phosphates in the musculus bulbocavernosus, m. ischiocavernosus, m. levator ani, the diaphragm, and the gastrocnemius in rats to which 250 mg of 2,4-D per kg of body weight was administered i.p. one hour before i.p. injection of radioactive phosphate and four hours before sacrifice. The 2,4-D administered had little effect on the incorporation of radioactive phosphate in the inorganic phosphate fraction of the skeletal muscle. However the rate of radioactive phosphate retention decreased significantly in the acid-soluble phosphate fraction. The findings support the hypothesis of the uncoupling of oxidative phosphorylation as the pathogenic mechanism of 2,4-D poisoning.

73-2455. Meiniel, R. (Biol. Anim., Univ. Clermont-Ferrand, Aubiere, France). **Etude histochimique de quelques activites enzymatiques surrenaliennes chez l'embryon de poulet normal et soumis au parathion; analyse particuliere de l'action anticholinesterasique de ce compose organophosphore. [Histochemical study of some adrenal enzyme activities in normal and parathion-treated chick embryos, specific analysis of the anticholinesterase activity of this organophosphate compound.]** *C. R. Soc. Biol. 126(12): 1712-1715; 1972.* (12 references) (French)

The effect of 5 mg or smaller doses of parathion, introduced into the vitellum five hours before sacrifice, was studied on the 3β-Δ^5-hydroxysteroid dehydrogenase, monoamine oxidase, non-specific phosphomonoesterase, and cholinesterase activity of 16 days' old chick embryos. Parathion did not seem to affect the β-Δ^5-hydroxysteriod dehydrogenase, monoamine oxidase, and phosphomonoesterase activities of the adrenal gland, but did inhibit the cholinesterase activity of the adrenal gland at low doses of 0.1 mg for an egg weighing 50 g. Effective inhibition of the acetyl cholinesterase activity in vitro requires a parathion concentration of 0.001 *M*, indicating the possible metabolism of parathion to paraoxon by the embryonal organism.

73-2456. Hammerschlag, R. S. (Univ. Maryland, College Park, MD). **Benomyl and methyl-2-benzimidazolecarbamate (MBC): biochemical, cytological and chemical aspects of toxicity to *Ustilago maydis* and *Saccharomyces cerevesiae*.** *Diss. Abstr. Int. 33(11): 5092B; 1973.*

In synchronous cultures of *Ustilago maydis* and *Saccharomyces cerevesiae* methyl-2-benzimidazolecarbamate (MBC) caused a mitotic arrest; inhibited DNA synthesis in *U. maydis* and cytokinesis in both organisms were secondary effects. Air over moistened benomyl, but not over MBC, contained a compound toxic to the organisms which was identified as butyl isocyanate (BIC). This compound was also found in benomyl solutions and inhibited respiration of *U. maydis* and *S. cerevesiae* in a manner similar to benomyl. Since MBC did not affect respiration and the toxicity of benomyl is attributed to its two breakdown products, MBC and BIC, the differential effects of benomyl preparations and of MBC on growth and metabolism in fungi must be caused by BIC. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-11,385).

73-2457. Call, D. J. (Univ. S. Dakota, Vermillion, SD). **Effects of dieldrin and selected polychlorinated biphenyls upon Japanese quail (*Coturnix coturnix japonica*) and their eggs.** *Diss. Abstr. Int. 33(11): 5330B; 1973.*

A sex-dependent weight loss occurred in Japanese quail fed dieldrin at 75 ppm for 14 days and in those fed Aroclor 1242 at 5000 ppm, Aroclor 1254 at 1250 ppm, and Aroclor 1260 at 1000 ppm. Toxicosis was observed

in birds treated with doses of polychlorinated biphenyls (PCBs), and some of the birds died. Brain residues of PCBs were higher in birds which died than in survivors. Egg production, egg weight, and egg size were significantly reduced by both dieldrin and Aroclor treatment, and eggshell thinning occurred at all doses of dieldrin and Aroclor used in the 21-day experiment. Reduction in erythrocyte numbers occurred with various Aroclor treatments, and dieldrin caused an elevation in serum total lipids. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-12,458.)

73-2458. Disney, G. W. (Univ. Tennessee, Knoxville, TN). **Alterations in sulfolipid metabolism in malathion-stressed rats.** *Diss. Abstr. Int. 33(11): 5364B; 1973.*

A statistically significant increase in $^{35}SO_4^{2-}$ incorporation into sulfolipid was observed in malathion-stressed rats at a dietary sulfate level of 0.1%. Malathion generally increased specific activities of liver lipoprotein macromolecules which were intensified by decreasing the level of dietary sulfate. Results of further investigations suggested that sulfate was being mobilized from sulfolipid. Arylsulfatase activity was significantly higher in livers of malathion-stressed rats than in control livers. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-12,400.)

73-2459. Overstreet, D. H. (Univ. California, Irvine, CA). **Biological mechanisms underlying the development of behavioral tolerance to diisopropylfluorophosphate.** *Diss. Abstr. Int. 33(11): 5428B-5429B; 1973.*

DFP treatment, intended to maintain brain cholinesterase levels in albino rats at 30% of normal, comprised injection of 1.0 mg/kg initially followed at three-day intervals by 0.5 mg/kg booster injections. Times for development of tolerance to DFP differed, depending on the criterion selected; return to baseline occurred on the fourth day of DFP treatment for temperature regulation, on the tenth day for reinforced responses in a single alternation task, and on the 13th day for drinking behavior. There was no return to baseline for nonreinforced responses in a single alternation task. The receptor change hypothesis for development of tolerance, which postulates a change in sensitivity of a receptor to its neurotransmitter, counterbalancing the change in transmitter level induced by the drug, was examined using a challenge study with other cholinergic drugs. Changes occurred in both muscarinic and nicotinic receptors during chronic DFP treatment, but the muscarinic changes were more extensive. Muscarinic receptor sensitivity decreases may be brought about by a reduction in receptor numbers, whereas nicotinic receptors may change in conformation. According to behavioral tests following administration of carbachol in different brain areas, the sensitivity of muscarinic receptors in hippocampus and anterior hypothalamus appears to be reduced during chronic DFP treatment. Lateral hypothalamic receptors are apparently unchanged. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-11,656.)

73-2460. Strang, R. H. (Louisiana State Univ. and Agr. and Mech. Coll., Baton Rouge, LA). **A study of the absorption, translocation and metabolism of two pyridazinone herbicides (San 6706, San 9789) by cotton, corn and soybean.** *Diss. Abstr. Int. 33(12) Part 1: 5606B; 1973.*

The absorption, translocation and metabolism of ^{14}C-4-chloro-5-(dimethylamino)-2-(alpha, alpha, alpha-trifluoro-*m*-tolyl)-3(2*H*)-pyridazinone (San 6706) and ^{14}C-4-chloro-5-(methylamino)-2(alpha, alpha, alpha-trifluoro-*m*-tolyl)-3(2*H*)-pyridazinone (San 9789) by cotton (*Gossypium hirsutum* L. var. Coker 203), corn (*Zea mays* L. var. WF 9), and soybean (*Glycine max* L. Merr, var. Lee) were investigated. Absorption and translocation appear to be major factors in determining the tolerance of these species to San 6706 or San 9789. Degradation of San 6706 and San 9789 did not appear to significantly influence the relative tolerances of the three species. Tolerant cotton mediated only limited breakdown of the herbicides, while the two susceptible species were able to rapidly metabolize the compounds by the process of *N*-demethylation. The degradation of San 6706 by corn and soybean did not represent a detoxification mechanism since the primary degradation product formed (i.e., San 9789) proved to have a greater phytotoxicity than San 6706. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-13,685.)

73-2461. Chambers, R. E. (Ohio State Univ., Columbus, OH). **DDT, social stress and the adrenal cortex in male rabbits.** *Diss. Abstr. Int. 33(11): 5470B-5471B; 1973.*

In 1, 4, and 16-wk feeding studies levels of 7 and 350 ppm DDT resulted in enlarged adrenals and livers in rabbits and alteration of in vitro production of four major corticoids. No obvious effects on general condition or growth were noted with the highest dose. The alteration in adrenal function was believed a consequence of increased metabolism of steroids by the liver. Total DDT residues in fat were as high as 3000 ppm and were 10 to 100 times greater than in the adrenals and liver, respectively. DDT residues in renal fat did not indicate functional changes produced in the liver and adrenals. TDE and DDE were the predominant metabolites found in the liver and accounted for 88% of the total residue. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-11,471.)

73-2462. Poore, R. E. (Vanderbilt Univ., Nashville, TN). **Studies of the metabolism of the insecticide *O,O*-diethyl *p*-nitrophenylphosphorothionate (parathion) to *O,O*-diethyl *p*-nitrophenyl phosphate (paraoxon) in vivo.** *Diss. Abstr. Int. Part 1 33(12): 5661B-5662B; 1973.*

A semiquantitative method for measuring the metabolism of parathion to paraoxon was established using the tissue binding of radioactive sulfur released when S^{35} labeled parathion is metabolized to paraoxon in vitro and in vivo. With this technique it was found that in vitro metabolism in the liver is 4 and 10 times, respectively, that in the lung and brain; in vivo the corresponding differences were 2 and 60 times. Pretreating rats with phenobarbital increased the rate of metabolism of parathion to paraoxon in vivo in eight out of nine tissues examined. Studies indicated that the amount of S^{35} bound in the liver and brain is related to the inhibition of AChE of red blood cells and brain, respectively. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-14,527.)

73-2463. Kay, K. (Environ. Sci. Lab., Mt. Sinai School Med., City Univ. New York, New York, NY 10029). **Toxicology of pesticides: recent advances.** *Environ. Res. 6(2): 202-243; 1973.* (324 references)

A review of the toxicology of the main classes of pesticides shows that many considerations other than the LD50 of the chemical are required to predict the health hazards of over-exposure to newly introduced materials. Organophosphates and carbamates inhibit AChE, disrupting neurofunction and sometimes causing respiratory failure. With the organophosphates the inhibition is irreversible except in the presence of certain oximes while reactivation of ChE is spontaneous and rapid in the case of carbamates. Delayed neurotoxicity, unrelated to ChE inhibition, has also been observed. The less acutely toxic chlorinated hydrocarbons tend to accumulate in the fat and, in some animals, to be mobilized under conditions of stress. Metabolism can result in the presence of substances more toxic than the parent compound. Behavioral changes, neurotoxicity, hepatotoxicity, and, in some cases, skin irritation are characteristic signs. Since these compounds generally induce broad-band mixed-function oxidases, effects of other foreign or endogenous compounds can be altered. The potential threat of mercury to human health, other than in gross neurotoxic exposures, is not understood. Damage to skin and mucous membranes caused by bipyridyl herbicides does not appear until several days after metabolism and excretion have been under way. Captan has been shown fetotoxic, mutagenic, and neurotoxic in lower forms of animals. Potential carcinogenicity of pesticide preparations may also present a hazard particularly when asbestos and petroleum oil are used.

73-2464. Seiler, J. P. (Swiss Fed. Res. Station Arboriculture, Viticulture and Horticulture, CH-9920 Waedenswil, Switzerland). **A survey on the mutagenicity of various pesticides.** *Experientia 29(5): 622-623; 1973.* (27 references)

Of 23 pesticides chosen as potential mutagens, 11 showed positive activity in tests with one or more strains of *Salmonella*. The results do not necessarily indicate that those compounds will be mutagenic in higher animals, but further studies should be done with the benzimidazoles and dioxins since they are persistent chemicals. The triazines gave a rather ambiguous response and prior studies have shown them to be mutagenic only in some cases. Even if there were no potential for mutagenesis with these compounds in mammals, the wisdom of continually applying them, knowing that they can create resistant strains of weeds etc., should be questioned.

73-2465. Yevets, M. A.; Korablev, M. V. (Dept. Pharmacol., Grodnen Med. Inst., Grodnen, USSR). **O vliyanii proizvodnykh ditiokarbaminovoi kisloty na fermentativnuyu aktivnost' al'dolazy i fosforilazy v organizme krys. [The effect of dithiocarbamic acid derivatives on the fermentative activity of the aldolase and phosphorylase in the organism of rats.]** *Farmakol. Toksikol. 35(4): 492-494; 1972.* (4 references) (Russian)

The effects of sodium *N,N*-diethyldithiocarbamate (DEDTC), *N,N,N,N*-tetraethylthiuramdisulfide (disulfiram), ethyl ester of *N,N*-dimethyldithiocarbamic acid, and zinc ethylene-bis-dithiocarbamate (zineb) were studied on the aldolase and phosphorylase activities of rats receiving the chemicals via the stomach once a day for 10 days at a dose of 1/20 LD50 per kg of body weight. All chemicals inhibited aldolase activity in the serum, spleen, and kidney; the ethyl ester of *N,N*-dimethyldithiocarbamic acid inhibited aldolase activity in the cerebrum and the liver, disulfiram inhibited aldolase activity in the myocardium, and DEDTC inhibited aldolase activity in the wall of the small intestine. The rates of phosphorylase inhibition by the compounds in the liver ranged from 51 to 69%. The corresponding rates of phosphorylase inhibition in the muscles ranged from 26 to 60%.

73-2466. Alekhina, S. M.; Khaykina, B. I. (Biochem. Lab., All-Union Sci. Res. Inst. Pestic., Polymer, Plastics Hyg. Toxicol., Kiev, USSR). **Vliyaniye lindana na aktivnost' laktatdegidrogenazy i yeye izofermentnyy spektr. [The effect of lindane on the activity of the lactate dehydrogenase and on its isoenzymatic spectrum.]** *Farmakol. Toksikol. 35(6): 734-737; 1972.* (7 references) (Russian)

The effect of lindane on the activity of total lactate dehydrogenase (LDH) and its isoenzymatic spectrum was studied in the blood serum and liver of albino rats. The animals were given 1.7 mg/kg (1/100 LD50) intragastric doses of lindane for 10, 30, 90, and 180 days, respectively. Total lactate dehydrogenase activity

decreased appreciably in the serum, and the isoenzymatic spectrum changed (decrease in LDH1, increase in LDH4, and subsequent increase in the M type subunits) during protracted administration of lindane. LDH1, LDH2, LDH3, and LDH4 activities increased, and the LDH5 activity decreased with reduced total hepatic LDH activity during 180-day exposure.

73-2467. Savateyev, N. V.; Brestkina, L. M.; Tonkopiy, V. D.; Pozharisskaya, T. D.; Frolov, S. F. (Author address not given). **Ispol'zovaniye kisloroda pod davleniyem pri lechenii ostrykh otravleniy khlorofosom. [Compressed oxygen in the treatment of acute trichlorfon poisonings.]** *Farmakol. Toksikol. 35(6): 738-741; 1972.* (17 references) (Russian)

The effect of pressurized oxygen on the recovery from acute poisoning with trichlorfon was studied in albino rats administered 1,000 mg/kg b.w. trichlorfon subcutaneously. Salivation, tremor, and cholinesterase activity inhibition of 80% in the blood and 13% in the brain were observed 10 min after trichlorfon administration; the rates of cholinesterase activity inhibition in the blood and in the brain were 100% and 76% after one hour. When atropine was administered 10 min after poisoning, salivation and tremor were relieved but the outcome of the poisoning was unaffected. When oxygen under 3 atm pressure was given 10 min after poisoning, the recovery rate increased 30-40% and cholinesterase activity normalized. A combination of oxygen with atropine acted as oxygen alone. Oxygen or atropine given one hour after poisoning had no positive effect, and atropine even increased mortality. A recovery rate of 90-100% was achieved with a combination of atropine and TMB-4. A combination of oxygen under 3 atm pressure, atropine, and TMB-4 normalized all animals in one hour.

73-2468. Vorob'yeva, N. M.; Lapchenko, V. S. (Kiev Sci. Res. Inst. Nutritional Hyg., Lab. Toxicol., Kiev, USSR). **Toksikologicheskaya kharakteristika novogo pestitsida antio. [Toxicological characteristics of the new pesticide antio.]** *Farmakol. Toksikol. 6: 104-107; 1973.* (3 references) (Russian)

The acute and chronic toxicity and cumulative action of antio (formothion) were studied in tests on mice, rats, and cats. The LD50 values determined in an acute poisoning test by introducing the poison via stomach tube were 83.3±10.3 mg/kg in mice, 218±75.4 mg/kg in rats, and 310±40.3 mg/kg in cats. Males, especially rats, were more sensitive than females. Principal symptoms of acute poisoning included depression, lachrymation, sialorrhea, muscular fibrillation, tremor, ataxia, and convulsion. Antio had a mildly pronounced cumulative action in subacute chronic tests with daily doses of 1/10, 1/20, and 1/50 of LD50 for 90 days. Cats and rats survived after intake of a total dose six times greater than the lethal dose determined in acute poisoning tests. The threshold dose of 0.38 mg/kg was determined in a 10-months' test with rats. Daily doses larger than 0.38 mg/kg significantly inhibited the cholinesterase activity in serum, red blood cells, liver, and brain; disturbed the carbohydrate metabolism and protein synthesis in the liver with increased albumin and decreased gamma-globulin levels; and caused venous plethora of parenchymatous organs, fatty degeneration of the hepatic parenchyma, and dystrophy of the myocardiac fibers.

73-2469. Krampitz, G. (Author address not given). **Pestizidrueckstaende im Stoffwechsel der Warmblueter. [Pesticide residues in the metabolism of warm-blooded animals.]** *Hohenheimer Arbeiten, Schriftenreihe der Universitaet Hohenheim, Allgemeine Reihe 61: 29-40; 1972.* (21 references) (German)

General ecological problems of pesticide residues, especially organochlorines, and studies on the metabolism and effects of pesticides in warm-blooded animals are reviewed. Aldrin and dieldrin were metabolized to hydrophilic compounds eliminated with feces. Endrin fed to rats metabolized to 9-keto-endrin, 9-hydroxy-endrin, and another monohydroxylated endrin derivative. The partial metabolism of organochlorine pesticides, not necessarily into harmless compounds, is due to intestinal microorganisms and to the liver. While part of the unchanged or metabolized pesticides is eliminated with the feces, another fraction, metabolized or not, is accumulated in the liver, bones, and tissues. Organochlorine pesticides, especially DDT, induced hepatic oxidases and inhibited other enzymes, such as carbonic anhydrase. Estrogenic effects of DDD (TDE) analogs and disturbances in the reproduction of birds of prey, constituting the last link of the food chain, demonstrate hormonal effects of organochlorine pesticides.

73-2470. Shabad, L. M.; Kolesnichenko, T. S.; Nikonova, T. V. (Inst. Exp. Clin. Oncol., Acad. Med. Sci. U.S.S.R., Moscow, USSR). **Transplacental and combined long-term effect of DDT in five generations of A-strain mice.** *Int. J. Cancer 11(3): 688-693; 1973.* (23 references)

Exposure of A-strain mice to DDT at daily dose levels of 50 ppm resulted in a significant increase (36.66%) in lung adenomas in the F_0 generation. Due to the pronounced toxic effect of the pesticide, no further generations could be obtained. A general toxic effect was observed following daily administration of 10 ppm DDT, but several offspring were obtained from each generation. In the F_0 generation lung tumors appeared in 19.05% of the animals, and a much higher incidence was noted among those that survived to 12 months. The incidence of tumors increased with each generation up to the F_3 and was not significantly greater than that of controls (10.88%) in the F_5 generation. The pattern observed was similar to that obtained during in vitro

studies of lung tissue. No other tumors were found in any of the mice.

73-2471. Story, K. O. (Fisons Ltd., Chesterford Park Res. Sta., Saffron Walden, Essex, England). **Control of cockroaches and other domestic pests with a new carbamate insecticide.** *Int. Pest Contr. 14(6): 6-10; 1972.* (3 references)

Ficam, a new, highly active broad-spectrum carbamate insecticide, acts as a reversible inhibitor of ChE. Acute oral toxicity is moderately high (LD50 for the rat is 170 mg/kg), but the effects are not particularly cumulative and recovery of animals from nonlethal exposure is rapid. The acute dermal toxicity is quite low (1000 mg/kg in the rat). Since the product is not very volatile, little hazard is connected with its use in poorly ventilated areas. No ill effects have been reported in men occupationally exposed to the insecticide.

73-2472. Wright, F. C.; Palmer, J. S.; Riner, J. C. (U.S. Livestock Insects Lab., Agr. Res. Serv., U. S. Dept. of Agr., Kerrville, TX 78028). **Retention of mercury in tissues of cattle and sheep given oral doses of a mercurial fungicide, Ceresan M.** *J. Agr. Food Chem. 21(4): 614-615; 1973.* (2 references)

A mercurial fungicide, formerly used, Ceresan M (ethyl mercury *p*-toluene sulfonanilide), was given in daily oral doses at 15 mg/kg to cattle for 7 or 12 days and to sheep for 4 or 7 days. Residues of mercury in hair, blood, and tissues were determined by atomic absorption spectrophotometry for 20 weeks after dosing had ceased. Residues of mercury increased in the hair of cattle to a maximum point and then began to decrease. Residues in brain and muscle of both cattle and sheep were lower initially than in liver and kidney and then decreased steadily during the 20-week postexposure. Mercury persisted in tissues of cattle throughout the study. (Author abstract reprinted by permission of the American Chemical Society)

73-2473. Shindy, W. W.; Jordan, L. S.; Jolliffe, V. A.; Coggins, Jr., C. W.*; Kumamoto, J. (Dept. of Plant Sci., Univ. of California, Riverside, CA 92502). **Metabolism of [^{14}C]naphthaleneacetic acid in kinnow mandarin.** *J. Agr. Food Chem. 21(4): 629-631; 1973.* (10 references)

Kinnow mandarin fruits were dipped in aqueous solutions of [^{14}C]*α*-naphthaleneacetic acid and extracts of the tissue were examined for radioactive constituents. The total amount of radioactivity per fruit remained relatively constant for the 240 days of the experiment, but concentrations decreased during fruit growth and development. A significant amount of the NAA was converted into 1-naphthaleneacetylaspartic acid and 1-*β*-D-glucose-*α*-naphthaleneacetate. Smaller amounts of two additional metabolites were found, but they were not identified. Naphthaleneacetic acid and the two major metabolites were identified by gas-liquid chromatography-mass spectrometry. (Author abstract reprinted by permission of the American Chemical Society)

73-2474. Feung, C.; Hamilton, R. H.; Mumma, R. O.* (Dept. of Biol. and Entomol., Pesticide Res. Lab. and Grad. Study Cent., Pennsylvania State Univ., University Park, PA 16802). **Metabolism of 2,4-dichlorophenoxyacetic acid. V. Identification of metabolites in soybean callus tissue cultures.** *J. Agr. Food Chem. 21(4): 637-640; 1973.* (13 references)

The metabolism of 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4-dichlorophenoxyacetylglutamic acid (2,4-D-Glu) was investigated in soybean callus tissue cultures, and the various metabolites were quantified. In addition to the major amino acid conjugates previously reported, 2,4-D-Glu and 2,4-dichlorophenoxyacetylaspartic acid (2,4-D-Asp), five new 2,4-D conjugates have been isolated and identified: alanine, valine, leucine, phenylalanine, and tryptophan. Callus tissue converted 2,4-D-Glu to a number of compounds, of which two ether-soluble metabolites have been identified (2,4-D-Asp and 2,4-D), and three aglycone metabolites have been identified (2,4-D, 4-hydroxy-2,5-dichlorophenoxyacetic acid,and 4-hydroxy-2,3-dichlorophenoxyacetic acid). These metabolites account for 83.5% of the radioactivity found in the tissue. A greater proportion of the 2,4-D-Glu was metabolized and converted to the ring-hydroxylated metabolites and to 2,4-D-Asp than was 2,4-D. (Author abstract reprinted by permission of the American Chemical Society)

73-2475. Bakke, J. E.; Price, C. E. (U. S. Dept. of Agr., Agr. Res. Serv., Metabolism and Radiation Res. Lab., Fargo, ND 58102). **Rat urinary metabolites from 2-methoxy-4,6-bis(isopropylamino)-*s*-triazine (prometone).** *J. Agr. Food Chem. 21(4): 640-644; 1973.* (7 references)

Nine urinary metabolites from ^{14}C-ring-labeled prometone (I) were either identified or characterized by mass spectrometry of their trimethylsilyl derivatives. The major urinary metabolites were ammeline (31.5%) and 2-methoxy-4,6-diamino-*s*-triazine (10–14%). The other metabolites were dealkylation and oxidation products of prometone. (Author abstract reprinted by permission of the American Chemical Society)

73-2476. St. John, Jr., L. E.; Lisk, D. E.* (Pesticide Residue Lab., Dept. of Food Sci., Cornell Univ., Ithaca, NY 14850). **Metabolic studies with chloropropylate acaricide in the dairy cow.** *J. Agr. Food Chem. 21(4): 644-646; 1973.* (6 references)

Excretion and metabolism of the acaricide chloropropylate (isopropyl 4,4′-dichlorobenzilate) were studied in a dairy cow. At a level of 5 ppm in the feed for 4 days, 0.11 and 5.93% of the compound were excreted

intact in the milk and feces, respectively. Major elimination occurred in the urine with excretion of 28.13 and 55.23% of the total chloropropylate dose, respectively, as 4,4′-dichlorobenzilic acid and conjugates of the latter compound. Excretion of 4,4′-dichlorobenzilic acid in feces represented 5.44% of the dose. Chloropropylate was stable in rumen fluid but it decomposed in the presence of the 10,000 × *g* supernatant fraction of beef liver. (Author abstract reprinted by permission of the American Chemical Society)

73-2477. Potter, J. C.; Boyer, A. C.; Marxmiller, R. L.; Young, R.; Loeffler, J. E. (Biol. Sci. Res. Cent., Shell Development Co., Modesto, CA 95352). **Radioisotope residues and residues of dichlorvos and its metabolites in pregnant sows and their progeny dosed with dichlorvos-^{14}C or dichlorvos-^{36}Cl formulated as PVC pellets.** *J. Agr. Food Chem. 21(4): 734-738; 1973.* (12 references)

In three separate trials pregnant sows were fed dichlorvos and dichlorvos-^{14}C, dichlorvos-^{14}C, and dichlorvos and dichlorvos-^{36}Cl, respectively, during the last third of the sows' gestation period at a rate of 4 mg of dichlorvos per kg of body weight per day. In all the trials the dichlorvos was formulated in polyvinyl chloride pellets containing 20-21% dichlorvos. After farrowing, the sows and piglets were held for periods as long as 21 days before being sacrificed. During this period the piglets nursed from their own mothers. The daily rates of excretion of ^{14}C from the sows which had been dosed with dichlorvos-^{14}C only were as follows: feces, 5.4%; the pellets recovered from the feces, 53.6%; urine, 4.3%; and expired air, 6.7%. The recovery of ^{36}Cl from the sows dosed with dichlorvos and dichlorvos-^{36}Cl was as follows: feces, 5.5%; the pellets recovered from the feces, 56.5%; urine, 26.1%; and sow carcass, 8.1%. No residues of dichlorvos, dichloroacetaldehyde, dimethyl dichlorvos, dichloroacetic acid, or dichloroethanol were found in the tissues of the sows and piglets, although the tissues contained ^{14}C and ^{36}Cl residues ranging from 0.3 to 18.0 ppm equivalents. The ^{14}C and ^{36}Cl residues in the tissues are believed to be due to degradation of the vinyl group in dichlorvos into ^{36}Cl ions and the incorporation of the ^{14}C into normal tissue constituents such as glycine, serine, creatine, glucose, glycogen, fatty acids, cholesterol, choline, lecithin, and ribonucleic acid. (Author abstract reprinted by permission of the American Chemical Society)

73-2478. Gutenmann, W. H.; Edgerton, L. J.; Lisk, D. J.* (Pesticide Residue Lab., Cornell Univ., Ithaca, NY 14850). **Feeding studies with ethephon growth regulator in the dairy cow.** *J. Agr. Food Chem. 21(4): 742-743; 1973.* (3 references)

A feeding experiment was conducted to study the metabolism and excretion of the plant growth regulator ethephon (2-chloroethylphosphonic acid) in a lactating cow. At a concentration of 5 ppm in the daily ration, no residues of the compound were found in milk or feces. About 9.8% of intact ethephon was eliminated in the urine. The compound degraded in the presence of fresh rumen fluid. (Author abstract reprinted by permission of the American Chemical Society)

73-2479. Schick, M. (N. Belmore, L.I., NY). **Survival with adrenal carcinoma.** *J. Amer. Med. Ass. 224(13): 1763; 1973.* (1 reference)

In a Letter-to-the-Editor reference is made to a patient apparently cured of metastatic adrenal carcinoma after treatment with a combination of fluorouracil and mitotane (*o,p′*-DDD, TDE). The patient is in excellent health seven years after the cancer was diagnosed and is currently receiving no chemotherapy.

73-2480. Turner, B. C.; Caro, J. H. (Agr. Environ. Qual. Inst., Agr. Res. Serv., U. S. Dept. of Agr., Beltsville, MD 20705). **Uptake and distribution of carbofuran and its metabolites in field-grown corn plants.** *J. Environ. Qual. 2(2): 245-247; 1973.* (9 references)

Carbofuran was applied to two experimental watersheds in broadcast and row application to study the uptake, distribution, and metabolism of the insecticide in corn (*Zea mays* L.). Plants were sampled at both silage and harvest stages, and plant parts were analyzed separately. Pesticide concentrations in the crop grown on the row application watershed were higher than those on the broadcast field, reflecting differences in treatment rates. Plants at harvest contained substantially lower residues than at the silage stage. Residues were concentrated in the leaves, with lesser amounts in the stalks and cobs and only traces in the grain. In the leaves over 90% of the carbofuran was metabolized to 3-hydroxycarbofuran and 3-oxocarbofuran, the former constituting 80 to 95% of the total metabolite content. Intact carbofuran predominated in the stalks and cobs. Although application rates were much higher than registered rates, residue levels in the plants were below established tolerances. (Author abstract by permission)

73-2481. Comstock, V. E.; Ford, J. H. (Res. Agron. Dept., North Central Region, Agr. Res. Serv., U. S. Dept. of Agr., Univ. of Minnesota, St. Paul, MN 55101). **Effects of MCPA applied to successive generations of flax.** *J. Environ. Qual. 2(2): 274-276; 1973.* (7 references)

Application of high rates of [(4-chloro-*o*-tolyl)oxy]acetic acid (MCPA) on four relatively homogeneous populations of flax (*Linum usitatissimum* L.) for seven successive generations and on two heterogeneous populations for three successive generations (F_2, F_3, and F_4) caused no detectable genetic change in yield, oil content, iodine value, or maturity. Tolerance to MCPA was not increased by successive generation treatment with MCPA. The lack of detectable mutants in

the progenies of flax populations sprayed with high rates of MCPA for several successive generations suggested that MCPA was not mutagenic. The frequency of mutations should not be increased as a result of successive applications of MCPA to commercially grown flax cultivars or to breeding populations. (Author abstract by permission)

73-2482. Cox, B.; Tha, S. J. (Dept. Pharmacol., Univ. Manchester, Manchester, M13 9PL, England). **The antinociceptive activities of oxotremorine, physostigmine and dyflos (DFP).** *J. Pharm. Pharmacol. 24: 547-551; 1972.* (13 references)

DFP injected subcutaneously in mice did not significantly alter the hot plate reaction time (HPRT) or significantly affect the increase in reaction time observed with injection of oxotremorine. Physostigmine caused a small, nonsignificant increase in reaction time, but did not potentiate the effect of oxotremorine. DFP and physostigmine inhibited mouse brain AChE, but oxotremorine did not. ACh levels may not be related to oxotremorine antinociceptive activity, or DFP may not have had an effect because it predominantly inhibits ChE rather than the specific enzyme.

73-2483. Paiement, J. (School Pharm., Laval Univ., Quebec, Canada). **Interaction between DDT and lecithin in spread monolayers.** *J. Pharm. Pharmacol. 25(4): 341-344; 1973.* (18 references)

The DDT-lecithin interaction was studied in spread monolayers, which closely resemble the physical state of those phospholipids in biological systems. A Letter-to-the-Editor reports that an interaction occurs in this system and that the stochiometry of the interaction is 1:1. The nature of the interaction could not be clarified, since characteristics of both molecular association and surface solutions were observed. Work should be directed toward verifying the action of DDT on bilayers which simulate axon membranes and its action on each component of those membranes.

73-2484. Portmann, J. E. (Min. of Agr., Fisheries and Food, Fisheries Lab., Burnham-on-Couch, Essex, England). **Results of acute toxicity tests with marine organisms, using a standard method.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 212-217.* (20 references)

Of various pollutants organochlorine and organophosphorus pesticides were by far the most toxic of substances tested to *Crangon* and *Cardium*. *Crangon crangon* was tested with 0.1 ppm DDT and 1 ppm azinphosmethyl, both concentrations being far in excess of the 48 hr LC50 values. *C. crangon* did not develop any detection mechanism, possibly because both types of insecticides act on the nervous system and thus prevent any response mechanism that could have been initiated. DDT at 0.0001 ppm also affected *Tetraselmis suecica* and *Isochrysis galbana*. Herbicides were less toxic than the insecticides tested with carbyne (barban) and maneb being the only ones tested which gave LC50 values of less than 10 ppm for *Crangon crangon*. The toxicity of herbicides to larvae does not appear particularly high. Herbicides were far more toxic to marine algae *Dunaliella tertiolecta* than were the pesticides, but more work is needed in the area of behavioral testing. Of all the species tested *Crangon crangon* was the most susceptible and *Cardium edule* the least. All testing was short term. The results indicated that larvae are more sensitive than the adults of the species by factors of from 3 to 100. Phytoplankton species are more sensitive than adult marine animals to most of the chemicals tested.

73-2485. Eisler, R. (EPA, Water Quality Office, West Kingston, RI 02892). **Pesticide-induced stress profiles.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 229-233.* (25 references)

Information on the major biological effects of pesticides on marine organisms is summarized, and the multiparametric approach for detecting toxicant-induced metabolic stress before obvious morphological or behavioral changes occur is discussed. Marine organisms can be affected in various ways by insecticides in concentrations not even sufficiently strong to control the insect pest for which they were originally designed. Metabolic disturbances are detected more readily if several parameters are simultaneously determined and plotted; the method appears to be limited only by the investigator's selection of variables. Profiles of the effect of several pesticides on specific biological variables or indicators for particular species have already been determined. Many natural variations may occur in the biological indicators selected for study due to age of the animal, salinity of the medium, length of acclimatization period to different temperatures, and other factors. As data accumulates it should be possible to establish the range in activity for a wide number of metabolic systems under different environmental conditions.

73-2486. Mitrovic, V. V. (Fac. Agr., Univ. Belgrade, Belgrade, Yugoslavia). **Sublethal effects of pollutants on fish.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 252-257.* (72 references)

Sublethal effects (biological, pathophysiological, pathomorphological) occur at concentrations not necessarily lethal even at prolonged exposures, but which increase the population mortality, decrease its size, or change its composition. Pesticides present in sublethal amounts affect marine life in various ways. Pathological changes in fish organs from pesticide exposure have been suggested, but the results are thus far inconclusive. Pathohistological changes are similar to changes from

other toxic substances and include damage to the gill lamellae, epithelial cells, mucous cells, liver, heart, oogonia, oocytes, hemoglobin, cholinesterase activity, growth rate, reproduction, egg viability, oxygen consumption, hypersensitivity to stimuli, and fish behavior. Often the pesticide influences the self-defense mechanism of the fish as well, thereby opening the way for invasion by secondary factors, such as infection and parasitic disease. Fish have recovered after having been seriously affected by a herbicide. The existence of a few fish which are more resistant to the ill effects of the pesticide or the evolution of resistant strains which can absorb more of the toxic material before suffering ill effects are dangerous prospects for man when these fish become his food.

73-2487. Engel, R. H.; Neat, M. J.; Hillman, R. E. (William F. Clapp Lab., Duxbury, MA 02332). **Sublethal chronic effects of DDT and lindane on glycolytic and gluconeogenic enzymes of the quahog, *Mercenaria mercenaria*. *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 257-260.*** (15 references)

Chronic exposure to contaminants may result in sublethal damage, often brought about by subtle alterations in metabolic processes which direct cellular mechanisms. Quahogs were covered with 7 to 10 cm mud and exposed for 30 weeks to DDT and lindane at 2μg/l. At the end of 30 weeks substantial numbers of nematodes, copepods, and other biotic forms were present indicating that toxic levels of the pesticides had not been reached. Gonad development was examined, and it appeared that spawning did occur and that the gonads were undergoing normal reabsorption. DDT reduced the glucose-6-phosphate dehydrogenase content of gill tissue to negligible values. Lindane increased the foot glucose-6-phosphate dehydrogenase activity by 59% on a tissue weight basis and 114% in terms of protein. A constant decrease in fructose diphosphatase activity resulted from exposure to either chemical, thus, chlorinated hydrocarbons may interfere with gluconeogenesis. Higher levels of phosphofructokinase were noticed. A concomitant increase in phosphofructokinase and decrease in fructose-diphosphate in the presence of DDT suggest DDT interferes with the critical allosteric interactions, thereby possibly increasing glucose use and suppressing gluconeogenesis. A slight but significant decrease in foot pyruvate kinase and a 75% increase in mantle lactic dehydrogenase resulted from either chemical. These results suggest that glycolysis is an operative metabolic pathway in molluscan tissue responding to stress conditions with compensating mechanisms. Chronic administration of sublethal doses of chlorinated hydrocarbons may lead to increased glucose degradation and suppression of gluconeogenesis.

73-2488. Ernst, W. (Inst. Meeresforsch., Bremerhaven, Germany). **Accumulation and metabolism of DDT-^{14}C (dichloro-diphenyl-trichloro-ethane) in marine organisms. *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 260-262.*** (6 references)

The marine organisms *Lanice conchilega*, *Nereis diversicolor*, and the flatfishes *Platichthys flesus* and *Solea solea*, which partly feed on the polychaetes, were exposed to DDT-^{14}C either orally on food particles or as an ethanol in water solution from which the pesticide was absorbed. Unchanged DDT was the only radioactive compound found in the *Nereis*-extracts, except when oral application was used, in which case traces of polar metabolites were detected. TDE and DDT derived compounds were detected in extracts from the coelomic fluid and the tubes of the polychaetes after repeated exposure of *Lanice* to DDT. *Lanice* with a DDT content of 230 ppb lost about 6% of their activity over a five-week period. In flatfish experiments a total of 5.4μg DDD-^{14}C was absorbed from the gastrointestinal tract of *Platichthys* in six hours. After this time, DDT levels were 20-260 ppb in brain tissue and 30-80 ppb in liver tissue. After 28 days DDT content in Platichthys tissues did not noticeably decrease; DDT derived compounds and TDE were detected in the gastrointestinal tract, flesh, and liver. These results indicate that the accumulation of DDT from very low environmental concentrations by marine polychaetes is important for the introduction of DDT and perhaps other persistent pesticides into the marine food chain. The absorbed DDT is metabolized in both polychaetes and flatfishes only after long periods of exposure or higher doses. Very low concentrations of 0.01 ppb led to a level of about 2 ppb in the *Lanice conchilega* in a short time.

73-2489. Davis, C. C. (Dept. Biol. Marine Sci. Res. Lab., Memorial Univ. Newfoundland, St. John's, Newfoundland, Canada). **The effects of pollutants on the reproduction of marine organisms. *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 305-311.*** (93 references)

Persistent insecticides move to the sea in water run-off or as dust in the air currents and affect reproduction in marine organisms. Residues enter the tissues of marine organisms and accumulate through the food chain so that the higher predators and fish-eating birds acquire the greatest concentrations. Impaired reproduction, particularly egg mortality, has caused a decline in many species of birds. It is suggested that DDT and dieldrin may affect the metabolism of testosterone and progesterone, thus leading to reduced sex activity. Chlorinated hydrocarbons may cause the induction of hepatic enzymes which metabolize the steroids, in turn influencing calcium metabolism in birds and causing thin and brittle egg shells. Another suggestion is that DDT inhibits avian shell-gland carbonic anhydrase, hence causing thinner egg shells. DDT reduces photosynthesis in marine phytoplankton, leading to reduction or reproduction by cell division. It is suggested that research is needed in the following areas: synergistic

effects of different types of pollutants; behavioral aspects of reproduction as affected by pollutants; and mechanisms by which reproduction is affected.

73-2490. North, W. J.; Stephens, G. C.; North, B. B. (W. M. Keck Eng. Labs., California Inst. Tech., Pasadena, CA 91109). **Marine algae and their relation to pollution problems.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 330-340.* (122 references)

Metallic elements can either stimulate or depress algal metabolism. Many other inorganic pollutants are released into the environment and all but ammonia depress algal metabolism. Toxic thresholds for organic pollutants tend to be higher than for inorganics. Organic compounds can have a great stimulating effect on algae growth, causing "blooms" in polluted areas. Organic pesticides are currently being investigated at both the toxic and sub-lethal levels in light of recent food chain implications. Undoubtedly, a wide range of sensitivities exists. The fact that DDT and dieldrin, when present in amounts exceeding solubility limits, increase photosynthesis inhibition suggests that these compounds have an influence in the non-dissolved state.

73-2491. Hannan, P. J.; Patouillet, C. (Ocean Sci. Div., U.S. Naval Res. Lab., Washington, D C 20390). **Nutrient and pollutant concentrations as determinants in algal growth rates.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 340-342.* (8 references)

The growth rates of *Chlorella pyrenoidosa sorokiniana* and *Phaeodactylum tricornutum* were affected differently by DDT (20 ppm) with acetone solvent (1,600 ppm), depending on the nutrient concentration. The *Chlorella* was resistant to the effects of DDT in all experiments, and the inhibitions observed were caused primarily by the large excess of acetone present as solvent. During three-day exposures for a given concentration of DDT, growth inhibition of algal cells decreased with time when the medium was diluted by a factor of 10^2, but increased with time at a ten-fold greater dilution. Similar results are obtained with anionic detergents, suggesting that cells suffering from nutrient deficiencies are less able to adapt to toxicants than are those which have been well supplied with nutrients. In short-term exposure, being measured over a four hour period, DDT added in concentrations of parts per billion inhibited CO_2 uptake in four different algae. The fluorescence measurement technique is useful since it allows measurements to be taken within filtration or extraction procedures, and the effect of the toxicant can be measured for several days, allowing observation of any recovery during exposure which might occur. However, results obtained with this method may not be interpreted quantitatively since changes in the chlorophyll *a* content of the cells may not exactly parallel growth; chlorophyll *a* content is responsible for the property of fluorescence.

73-2492. Halstead, B. W. (Int. Biotoxicol. Cent., World Life Res. Inst., Colton, CA 92324). **Toxicity of marine organisms caused by pollutants.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 584-594.* (86 references)

Pesticides and other pollutants affect marine life and consequently have the potential to affect human life. Chlorinated hydrocarbons affect the metabolism of plankton. It is suggested that selective toxic stress by DDT on certain algae may alter the species composition of a natural phytoplankton community. In some cases this causes a highly toxic dinoflagellate to develop and can lead to poisonous shellfish and possibly toxic fishes. The accumulation and concentration of DDT in the adipose tissue of the bodies of predatory animals is a serious threat. The effect of pesticides on shellfish, particularly oysters, is of great importance because of food value of these organisms and because of their ability to concentrate the pesticide. Polychlorinated biphenyls are also persistent and subject to bioaccumulation. Chlorinated hydrocarbons may cause liver necrosis and cirrhosis, anemia, polycythemia, agranulocytosis, panmyelophthisis, and maturation arrest in bone marrow in animals and man. They have also produced benign and malignant cancers and leukemia. Tri-*p*-anisyl-chloroethylene and methoxychlor produce estrogenic activity in animals and thus might lead to cancer in the breast, uterus, bladder, kidney, testis, and hematopoietic tissue. Some synthetic auxins and carbamates may also be cancer producers.

73-2493. Schulz, D. (Max-von-Pettenkofer-Inst., Bundesgesundheitsamt, Berlin-Lichterfelde, Germany). **Toxikologische Untersuchungen ueber den Einfluss von Herbiziden auf die Organe des Karpfen. [Toxicological studies on the effects of herbicides on the organs of carp.]** *Muenchner Beitr. Abwasser Fisch. Flussbiol. 23: 108-119; 1972.* (16 references) (German)

Experiments and field observations on the effects of Dalapon-Na, sodium trichloroacetate, Karmex (diuron), and liquid Hedonal (2,4-D) on different organs of carp are reviewed. Increased moisture content of the muscles, hyalinization of muscle fibers, partial necrosis of gills with loss of epithelium and mucosa, and increased lymphocyte level in the gill region were observed in carp kept in water with 7 ppm of sodium trichloroacetate for 63 days. Another experiment with 2.5 ppm of dalapon in the form of dalapon-Na revealed acidophilia of the exocrine pancreas, significantly decreased RNA level, and partial lysis of the endoplasmic reticulum. Karmex used in concentrations of 0.2-12 ppm caused edema of the gallbladder, inflammation of bile ducts, proliferation in the endocardium with dystrophic degeneration of the myocardium, and

inflammation and proliferation of the endothelium. Areflexia, hyperemia of the cerebral vessels, alterations of nerve cells, tigrolysis, and basophilia developed in carp kept in water containing 0.0002 ml of liquid Hedonal (55% of 2,4-D) for 25 days.

73-2494. Boyer, M. G.; Perry, E. (Dept. Biol., York Univ., Downsview, Ontario, Canada). **Diversity in soil fungi as influenced by DDT.** *Mycopathol. Mycol. Appl. 49(4): 255-262; 1973.* (21 references)

Laboratory experiments using Pontypool sand showed no pronounced suppression or enhancement of total numbers of soil fungi after treatment with DDT at 1 ppm or 2 ppm over a 14 week period. A decrease in the diversity index which persisted for nine weeks was observed when the species of *Penicillium* were studied at a level of 2 ppm DDT. The 1 ppm DDT treatment did not always reduce the diversity index, but results at this level support the interpretation that DDT can reduce the diversity of species in this genus.

73-2495. Aziz, S. A.; Knowles, C. O. (Dept. of Entomol., Univ. of Missouri, Columbia, MO 65201). **Inhibition of monoamine oxidase by the pesticide chlordimeform and related compounds.** *Nature (London) 242(5397): 417-418; 1973.* (4 references)

Inhibition of monoamine oxidase (MAO) has been suggested as the mechanism for the insecticidal-acaricidal activity of chlordimeform. Symptoms in chlordimeform-poisoned rats are similar to those of known MAO inhibitors. The inhibitory activity of chlordimeform and its analogs was examined using the supernatant from a 500*g* centrifugation of a rat liver homogenate as the MAO source and kynuramine as the substrate. Compared with classical MAO inhibitors, chlordimeform was a moderately strong inhibitor. However, demethyl-chlordimeform, a metabolite previously isolated from mammals and arthropods, was a more potent inhibitor than chlordimeform. Maximum inhibitory potency was associated with aryl alkylformamidines containing the 4-chloro-*o*-tolyl moiety. Although the formamidines may interfere with other enzymes as well, it seems plausible that the toxic action of these acaricides in mammals and target organisms is related to interference with the MAO-biogenic amine system.

73-2496. Benezet, H. J.; Matsumura, F. (Dept. Entomol., Univ. Wisconsin, Madison, WI 53706). **Isomerization of γ-BHC to α-BHC in the environment.** *Nature (London) 243(5407): 480-481; 1973.* (10 references)

A considerable increase in α-BHC was found after a 30-day incubation of γ-BHC (lindane) with bottom sediments taken from a 10 foot water depth in Pearl Harbor, Hawaii. Only 40% of the γ-BHC was recovered from the sediment. Approximately 70μg of α-BHC was obtained when 15 mg of γ-BHC was incubated for four weeks in the presence of *Pseudomonas putida* and NAD. In smaller experiments the extent of α-BHC formation was 3% while a 19% conversion to γ-BTC was observed. Normally *P. putida* produced γ-PCCH.

73-2497. Ooka, R.; Komoto, M.; Morikawa, S.; Kikuchi, N.; Arimoto, H.; Tsukihana, R.; Fukami, Y.; Tanahashi, Y.; Ito, K. (Sch. of Ophthalmol., Fac. of Med., Toho Univ., Tokyo, Japan). **[Ocular disturbances on experimentally poisoned rats by an organophosphorus pesticide.]** *Nippon Ganka Gakkai Zasshi (J. Jap. Ophthalmol. Soc.) 77: 39-40; 1973.* (Japanese)

Young Donryu rats (b.w. 100 g) were divided into 5 groups (20 animals each) and fed diet containing fenitrothion at levels of 600, 300, 150, 100, and zero ppm, respectively, for eight weeks. Total blood ChE activity was determined periodically and ocular symptoms such as the change of ophthalmologic pressure, degree of projection of eyeballs, and the change of fundus oculi observed. Higher doses (600 and 300 ppm) decreased blood ChE activity, produced erosion and ulcers of the cornea, and caused the cornea to protude. Lower doses (150 and 100 ppm) did not produce these symptoms and blood ChE activity was normal. Some changes, peaking at the second week, were observed on eye-lids and palpebral conjunctiva of the rats receiving higher doses. No noticeable changes were observed on feed-intake, weight gain, blood pictures, liver function, ophthalmological pressure, and the fundus oculi in treated animals. Administration of ^{14}C-glucose showed that glucose metabolism was accelerated in rats administered fenitrothion. Rats with corneal protuberance were injected with a very small amount of acetylcholine s.c. Red colored tears, containing degraded erythrocytes, occurred; however, red tearing was not observed in guinea pigs, rabbits, and mice.

73-2498. Tokoro, T.; Suzuki, K.; Otsuka, J.; Suzuki, H. (Sch. of Ophthalmol., Fac. of Med., Tokyo Med. and Dent. Univ., Tokyo, Japan). **[The changes of refraction and ophthalmological pressure of experimental chronically intoxicated beagles by an organophosphorus pesticide.]** *Nippon Ganka Gakkai Zasshi (J. Jap. Ophthalmol. Soc.) 77: 40; 1973.* (Japanese)

The theory that the occurrence of myopia in children in Saku and Moriguchi regions is caused by organophosphate pesticides was tested. Ethylthiometon at 5-15 mg/day/head was orally administered to five 6-month-old beagles for two years, the total dose amounting to 2300-6900 mg per animal. Change in ocular refraction, degree of astigmatism, ophthalmological pressure, and factors of refraction were determined, erythrocyte ChE activity examined, and the results compared to six control dogs. Myopia appeared four months after initial administration in treated dogs. A tendency towards direct astigmatism was also observed although depth of anterior chamber, thickness of lens,

and length of ocular axis were not significantly different. Decrease of erythrocyte ChE activity and ocular refraction, degree of myopia during nine months, progress of corneal astigmatism, and degree of elongation of ocular axis were significantly correlated. The intraocular ophthalmological pressure increased after one year of daily administration and decreased after two years. Corneal astigmatism was the same as total astigmatism after four months' administration; the total astigmatism exceeded that of corneal. These findings resembled those reported on the children in Saku and Moriguchi regions and confirmed that a repeated administration of ethylthiometon causes myopia in beagles.

73-2499. Ferry, D. G.; McQueen, E. G.; Owen, D. (Toxicol. Res. Unit, Med. Res. Council N. Zealand, P. O. Box 913, Dunedin, N. Zealand). **Failure of ethanol and phenobarbitone to reduce organochlorine pesticide residues in sheep.** *N. Z. J. Agr. Res. 16(2): 105-110; 1973.* (47 references)

Residues of *p,p'*-DDT, *p,p'*-DDD (TDE), and *o,p'*-DDT in the fat of sheep given a single oral dose of technical DDT showed a linear decline after the first two weeks; *o,p'*-DDT and *p,p'*-DDD were eliminated more rapidly than *p,p'*-DDT. The fat levels of *p,p'*-DDE increased over the first 13 weeks and then remained at the same level for the remaining 15 weeks. The ratios of pesticide in fat and blood were of the order of 2000:1. Administration of ethanol for three weeks in the drinking water of sheep 24 weeks after dosing with DDT had no effect on the rate of decline of DDT or its metabolites. Intramuscular injection of phenobarbitone 12 weeks after dosing with DDT for 11 weeks also had no noticeable effect on the residue patterns in fat.

73-2500. Lillie, R. J.; Cecil, H. C.; Bitman, J.; Fries, G. F. (Anim. Sci. Res. Div., Agr. Res. Serv., Agr. Res. Cent., Beltsville, MD 20705). **Dietary calcium, DDT source and age of hen on the reproductive performance of caged White Leghorns fed DDT.** *Poultry Sci. 52: 636-644; 1973.* (7 references)

In Experiment 1 eight groups of 20 caged White Leghorn pullets each were fed 0, 10, or 50 ppm technical grade DDT from two different manufacturers (#1 or #2), 10 or 50 ppm combination of pure DDT isomers, or 50 ppm *p,p'*-DDT in a 3.5% calcium breeder diet, and eight counterpart groups were fed the same pesticides in a 1.5% calcium diet for 40 weeks. The traits studied were body weight gains, egg production, livability, feed intake, fertility, and hatchability. Significant effects included calcium level for body weight gains, egg production, livability and feed intake, in favor of 3.5% calcium, irrespective of DDT, and calcium X diet for body weight changes, in which some of the pesticide-supplemented groups were significantly different from one another but none were superior to the control group on each calcium level. In Experiment 2 four groups of 20 pullets each were fed 0, 10 or 50 ppm technical grade DDT #1 or 50 ppm *p,p'*-DDT in a diet containing 3.5% calcium for 20 weeks, 3.0% the next 12 weeks, and 1.0% the final 8 weeks. The data showed no basic differences due to DDT among pullets fed periodic decreases of calcium, as compared with the controls. Experiment 3 consisted of six groups of yearling hens fed 0, 10, or 50 ppm technical grade DDT #1 or #2 or 50 ppm *p,p'*-DDT in a 3.5% calcium diet. The 28-week data indicated that yearling hens significantly gained less and laid fewer eggs than their counterpart pullet groups fed 3.5% calcium in Experiment 1, irrespective of DDT. DDT effects were nonsignificant between hens and pullets for all traits studied. (Author abstract by permission)

73-2501. Sherman, M.; Herrick, R. B. (Coll. of Tropical Agr., Univ. of Hawaii, Honolulu, HI 96822). **Fly control and chronic toxicity from feeding Dursban (*O,O*-diethyl *O*-3, 5, 6-trichloro-2-pyridyl phosphorothioate) to laying hens.** *Poultry Sci. 52: 741-747; 1973.* (12 references)

The effects of administering technical Dursban (chlorpyrifos) at concentrations of 25, 50, and 200 ppm in the feed of laying hens were studied over a 52 week period. The estimated mean daily intake of Dursban was 2.48, 5.12, and 20.44 mg per hen for those receiving 25, 50, and 200 ppm, respectively. Dursban at 50 ppm resulted in excellent control of larvae of *Musca domestica* L., *Fannia pusio* (Wiedemann), *Chrysoma megacephala* (F.), and *Boettcherisca peregrina* (Robineau-Desvoidy) but only moderate control of *Parasarcophaga argyrostoma* (Robineau-Desvoidy). No hen mortality occurred that could be attributed to the insecticidal treatment. There was a direct relationship between Dursban concentration and blood plasma cholinesterase inhibition. However, overall feed consumption, body weight, egg production, feed efficiency, egg weight, interior egg quality, and shell thickness were normal. Eggs from treated hens had no detectable off-flavors or off-odors. (Author abstract by permission)

73-2502. Matsueda, S.; Otaki, Y.; Kudo, N.; Sato, M.; Ishida, S.; Mikami, M. (Dept. Gen. Ed., Hirosaki Univ., Hirosaki, Aomori 036, Japan). **Enzymic histochemical studies on the blood cholinesterase activity inhibition of ethylparathione and methylparathione.** *Sci. Rep. Hirosaki Univ. 19(1): 1-10; 1972.* (22 references)

In vitro a dose-related inhibition of rat blood ChE by parathion was observed in the concentration range from 10^{-5} to $10^{-3}M$, while no change was observed in serum ChE. The inhibition increased with time of exposure of blood to the chemical. Methyl parathion at the same concentrations did not significantly affect either ChE, and a slight increase was observed in ChE activity from both sources after 120 min. When $10^{-3}M$ methyl or ethyl parathion was added, the histochemical and blood cell ChE picture changed with time, sug-

gesting a relation between the biochemical assay values and histochemical pictures.

73-2503. Spielmann, H.; Meyer-Wendecker, R.; Spielmann, F. (Pharmakol Inst., Freie Univ. Berlin, 1 Berlin 33, Thielallee 69/73, Germany). **Influence of 2-deoxy-D-glucose and sodium fluoroacetate on respiratory metabolism of rat embryos during organogenesis.** *Teratology 7(2): 127-134; 1973.* (24 references)

Sodium fluoroacetate (SFA) caused a linear decrease in the QO_2 (oxygen consumption) of adult kidney slices at concentrations between 10 μM and 100 mM, and yielded an S-shaped dose-response curve for rat embryonic tissues (day 11 and day 12). Increasing concentrations of sodium fluoroacetate were less effective in inhibiting oxygen consumption in embryonic tissue when 40 to 50% inhibition was reached. A linear response was obtained in both tissues with concentrations of 2-deoxy-D-glucose (2DG) from 500 μM to 50 mM. With 2DG a higher rate of inhibition was exhibited in day 11 embryos than in day 12 embryos or adult kidney tissue while the inhibitory effect of SFA was generally lower in embryonic tissue than in adult kidney tissue. The results are in agreement with a suggested change from glycolysis to an oxidative, respiratory metabolism during organogenesis. Administration of a single dose of SFA, just below the LD50, or 2DG to pregnant rats on day 9 or 10 of pregnancy reduced the QO_2 and dry weight of the embryos at day 11, but not day 12. This treatment was nonteratogenic.

73-2504. Younger, R. L. (U.S. Dept. of Agr., Agr. Res. Serv., Vet. Res. Div., Toxicol. Res. Lab., Kerrville, TX 78028). **Effects of three alkylating compounds on the gross development of chicken embryos.** *Toxicol. Appl. Pharmacol. 24(3): 423-433; 1973.* (36 references)

The effects of apholate, metepa, and tepa on developing chicken embryos were studied after yolk sac injection of saline solutions of these compounds at various dosages. Without regard to day of injection or dose (days 1-4 of incubation), apholate-injected eggs had the highest incidence of cumulative mortality and the lowest mean body weight of day 18 viable embryos, followed by the tepa-injected group, then the metepa-injected group. Significant differences in mean body weights for viable day 18 embryos existed between compound-treated groups and controls ($p<0.005$), between apholate and metepa groups ($p<0.005$), between tepa and metepa groups ($p<0.005$), but not between apholate and tepa groups. The incidence of defective embryos, combined on day 18, differed significantly between compound-treated groups and controls ($p<0.005$). Each aziridine compound induced one or more malformations in chicken embryos that were basically similar and increased the incidence of certain spontaneous defects. Deformities common to compound-treated groups were beak, cranial, ocular, leg, and digit defects. Defects common to both compound-treated and control groups were ectopic viscera, deformed digits, and general edema. (Author abstract by permission, abridged)

73-2505. Isom, G.; Way, J. L. (Dept. Of Pharmacol., Washington State Univ., Coll. of Vet. Med. and Coll. Of Pharm., Pullman, WA 99163). **Cyanide intoxication: protection with cobaltous chloride.** *Toxicol. Appl. Pharmacol. 24(3): 449-456; 1973.* (25 references)

Protection against the lethal effects of cyanide can be elicited by administration of cobaltous chloride, either alone or in combination with sodium nitrite and/or sodium thiosulfate. Potency ratios derived from the LD50 values were compared in groups of mice premedicated with cobaltous chloride and/or sodium thiosulfate and/or sodium nitrite. Under the conditions of our experiment cobaltous chloride alone is slightly more effective than sodium nitrite; when it is combined with sodium nitrite, an additive effect is obtained. When cobaltous chloride is administered in combination with sodium thiosulfate, a dramatic antagonism of the lethal effects of potassium cyanide is observed. The synergistic antidotal effect of cobaltous chloride may be related to the physiological disposition of the cobaltous ion and its ability to chelate both cyanide and thiocyanate ions. (Author abstract by permission)

73-2506. Muacevic, G. (C. H. Boehringer Sohn, Pharmaforschung-Biologie, Abt. Pharmakol., Ingelheim am Rhein, Germany). **Acute toxicity and cholinesterase inhibition in vivo of bromophos-ethyl.** *Toxicol. Appl. Pharmacol. 25(2): 180-189; 1973.* (15 references)

The acute toxicity of bromophos-ethyl is described. The LD50 values obtained are: rat, 107 mg/kg, po; mouse, 230 mg/kg, po; dog, about 360 mg/kg, po; rabbit, about 500 mg/kg, cutaneously; and quail, 200 mg/kg, po. After oral administration of 2 X 600 mg/kg and daily doses of 2.5 mg/kg administered for 30 days, no neurotoxic effects were detected in hens. Aqueous emulsions in concentrations up to 9% were well tolerated by the conjunctiva. In combination with coumaphos, phosalone, chlorfenvinphos, parathion, and bromophos, the acute toxicity in the rat was increased; there was, however, no synergistic effect in combinations with ethion, endosulfan, and dioxathion. In rats a maximal inhibition of the cholinesterase was found in the blood after 2 hr and in the brain after 4 hr, with a reversal to 50% inhibition in the blood after 48 hr and to 50% inhibition in the brain after 72 hr. A complete return to normal was produced in the blood after about 72 hr and in the brain after 10-12 days. Chlorinated hydrocarbons (lindane, heptachlor) reduced the acute toxicity of bromophos-ethyl. Atropine and several oximes (obidoximechloride, trimedoximebromide) could antagonize the effects of bromophos-ethyl. (Author abstract by permission)

73-2507. Wakeling, A. E.; Schmidt, T. J.; Visek, W. J. (Fertility Res. Unit., Upjohn Co., Kalamazoo, MI). **Effects of dieldrin on 5α-dihydrotestosterone binding in the cytosol and nucleus of the rat ventral prostate.** *Toxicol. Appl. Pharmacol. 25(2): 267-275; 1973.* (28 references)

The effects of dieldrin on binding of 5α-dihydrotestosterone by a protein fraction of the cytosol and nucleus of the rat ventral prostate were studied. Minced tissue incubated with 10 ppm of dieldrin in the incubation medium showed a reduction of 5α-dihydrotestosterone binding which averaged 36±2% in the cytosol fraction and 33±4% in the nuclear fraction. The antiandrogen, cyproterone acetate, similarly inhibited binding by 57±6% in the cytosol and 67±4% in the nucleus. Incubation studies with a proteolytic enzyme showed that the binding of the hormone is predominantly to a protein fraction. Nucleases had little effect on the binding, but lipase reduced it significantly, indicating involvement of lipid in the binding fraction. Results of detergent washing of isolated nuclei labeled with [^{3}H]5α-dihydrotestosterone or [^{14}C]-dieldrin suggested that some of both the dieldrin and the hormone were bound to the nuclear membrane. (Author abstract by permission)

73-2508. Hrdina, P. D.; Singhal, R. L.; Peters, D. A. V.; Ling, G. M. (Dept. of Pharmacol., Fac. of Med., Univ. of Ottawa, Ottawa, Canada). **Some neurochemical alterations during acute DDT poisoning.** *Toxicol. Appl. Pharmacol. 25(2): 276-288; 1973.* (37 references)

Administration of a lethal dose (600 mg/kg) of *p,p'*-DDT to rats produced typical neurotoxic signs (e.g., hyperexcitability, tremors, convulsions, and hyperthermia) and resulted in marked changes in brain acetylcholine (ACh), norepinephrine (NE) and 5-hydroxyindoleacetic acid (5-HIAA). Significant decreases in the amounts of cortical and striatal ACh as well as of brainstem NE were noted 5 hr after the administration of the insecticide. No significant alterations were found in striatal dopamine (DA) and brainstem 5-hydroxytryptamine (5-HT). However, brainstem 5-HIAA was significantly enhanced after treatment with *p,p'*-DDT. In pargyline-pretreated rats, *p,p'*-DDT produced increases in 5-HT which were greater than those observed in animals given the monoamine oxidase (MAO) inhibitor alone. Treatment with 6-fluorotryptophan (6-FT) or α-methyl-*p*-tyrosine (α-MT), inhibitors of 5-HT or NE synthesis, respectively, prevented the DDT-induced hyperthermia, but not the tremors and convulsions. In contrast, administration of *p*-chlorophenylalanine (*p*CPA) blocked all of the neurotoxic signs of *p,p'*-DDT. In addition, cycloheximide, but not actinomycin D, prevented the insecticide-induced changes in striatal ACh and brainstem 5-HIAA, as well as the occurrence of tremors and hyperthermia. These results suggest that changes in the metabolism of brain 5-HT and NE may be responsible for the DDT-induced hyperthermia, while the tremors and convulsions seen after an acute lethal dose of this insecticide may be related to changes in brain ACh. (Author abstract by permission)

73-2509. Spicer, E. J. F.; Barry, D. H. (Dept. Pathol., Huntingdon Res. Cent., Huntingdon, England). **A quantitative histochemical bio-assay system for D.D.T. in the carp, *Cyprinus carpio* L.** *IN: Toxicological Problems of Drug Combinations, S. B. De C. Baker, G.A. Neuhaus, ed., Excerpta Medica, Amsterdam, 1972, p. 307.*

Carp exposed to DDT at concentrations of 0.034, 0.021, 0.031, and 0.008 ppm exhibited a dose related increase of enzyme activity in all liver enzymes tested (non-specific esterase, acid phosphatase, glucose-6-phosphate dehydrogenase, glucuronidase and glucose-6-phosphatase) except alkaline phosphatase. The enzyme was quantitated in fresh cryostat sections of the liver using a Zeiss scanning microscope photometer. Four out of six fish died at the highest concentrations of DDT and some morphological changes were observed in livers from these fish. Other studies have shown a similar dose relationship between enzyme activity and organophosphate pesticides. This type of response could be utilized in a comparative bio-assay system of the toxic effects of pesticides.

73-2510. Rauws, A. G.; Van Logten, M. J. (Lab. Pharmacol. Toxicol., Nat. Inst. Pub. Health, P.O. Box 1, Bilthoven-2660, The Netherlands). **The influence of dichlorvos from strips or sprays on cholinesterase activity in chicken.** *Toxicology 1(1): 29-41; 1973.* (10 references)

Plasma ChE was significantly depressed in chickens exposed to five and two Vapona strips (dichlorvos) in a minimally ventilated room with a capacity of 32.8 m^3 for 21 full days and to two strips 16 hr/day for 28 days. No decrease was noted after exposure to one strip for 21 full days and to two strips 8 hr/day for 28 days. Brain AChE, determined after each experiment, was significantly lower only after exposure to 5 or 2 strips for 21 full days. Approximately 225 mg/day was lost from the strips during the course of the experiments. Plasma ChE was significantly decreased in only one 5-day experiment with aerosol sprays of dichlorvos in which animals were not caged. A pronounced effect on both plasma ChE and brain AChE was found during a 3-wk exposure to dichlorvos spray. Human plasma ChE and chicken plasma ChE exhibited similar sensitivities to dichlorvos in in vitro assays.

73-2511. Verschuuren, H. G.; Kroes, R.; Van Esch, G. J. (Lab. Toxicol., Nat. Inst. Pub. Health, Bilthoven-2660, The Netherlands). **Toxicity studies on tetrasul. I. Acute, long-term and reproduction studies.** *Toxicology 1(1): 63-78; 1973.* (10 references)

In acute, chronic, and reproductive studies the no effect level of tetrasul was 10 ppm. Guinea pigs, in which the oral LD50 was 0.50 g, were more sensitive to the compound than rabbits, rats, or mice. Sex did not affect sensitivity of the animals, but toxicity was greater after oral than after intraperitoneal administration due to better absorption. The results of 2-yr feeding studies in rats indicate an inhibition of food intake and growth at 1000 and 3000 ppm levels, and survival in these animals was lower. At six months a reduction of hemoglobin occurred with dose levels of 200 ppm or higher. A dose-related incidence of stridor was observed at doses of 50 ppm and above after four months. Significant increases in liver and thyroid weights were noted at doses of 200 ppm and greater, and histological alterations generally observed in the liver after administration of enzyme inducers were present at these dose levels. Hyperplastic changes in the thyroid occurred at the 100 and 300 ppm levels. Reproductive performance was diminished in a 3-generation study at the 100 and 300 ppm doses, and some decreased fertility was found in males of the 50 and 200 ppm groups.

73-2512. Verschuuren, H. G.; Kroes, R.; Den Tonkelaar, E. M. (Lab. Toxicol., Nat. Inst. Pub. Health, Bilthoven, The Netherlands). **Toxicity studies on tetrasul. II. Short-term comparative studies in 6 animal species.** *Toxicology 1(2): 103-112; 1973.* (11 references)

During 12-wk toxicity studies in which 0, 50, 200, 1000, and 3000 ppm doses of tetrasul were included in the diet of mice, rats, guinea pigs, rabbits, mini-pigs, and chickens, the liver was the target organ. Increased liver weights were observed in the 50 ppm group in chickens, in the 200 ppm group in all but the rat, and in all the 1000 ppm groups. Liver function tests showed liver damage in some species with doses as low as 200 ppm. In all species except the chicken "V101-cells" (enlarged, abnormal liver parenchymal cells) were induced at the 50 ppm level and "smooth endoplasmic reticulum (SER)-whorls" were found at higher doses in all but mini-pigs. Induction of microsomal liver enzyme activity was noted only with mini-pigs and rats. Using the histopathology and enzyme induction as criterion, rats and mini—pigs were the most sensitive and mice were the least sensitive, but chickens, mini-pigs, rabbits, and guinea pigs were most sensitive in terms of growth retardation.

73-2513. Verschuuren, H. G.; Kroes, R.; Den Tonkelaar, E. M. (Lab. Toxicol., Nat. Inst. Pub. Health, Bilthoven, The Netherlands). **Toxicity studies on tetrasul. III. Short-term comparative studies in rats with tetrasul and structurally related acaricides.** *Toxicology 1(2): 113-123; 1973.* (14 references)

Comparative toxicities of five acaricides administered in the feed of rats for 90 days were kelthane > tetrasul and chlorfenson> V110 (2,4,5,4′-tetrachlorodiphenylsulfoxide) > tetradifon. Kelthane (dicofol) at 3000 ppm was lethal for both sexes and retarded growth at the 50 ppm level while no growth retardation was observed with tetradifon. All compounds induced liver microsomal enzymes at low doses, and some indication of liver damage was obtained in liver function tests after administration of kelthane, tetrasul (males), and chlorfenson (males). Increased thyroid and liver weights were found with all compounds tested and the effect was more pronounced in males. Smooth endoplasmic reticulum (SER) whorls occurred with each compound at higher levels, and histological alterations were found in thyroids of all but the kelthane-treated animals.

73-2514. Litchfield, M. H.; Daniel, J. W.; Longshaw, S. (Ind. Hyg. Res. Lab., I. C. I. Ltd., Alderley Park, Macclesfield, Cheshire, England). **The tissue distribution of the bipyridylium herbicides diquat and paraquat in rats and mice.** *Toxicology 1(2): 155-165; 1973.* (15 references)

Paraquat and diquat were rapidly distributed throughout most tissues except brain and spinal cord after intravenous injection into mice. Low levels in brain and spinal cord were detected at 10 min with diquat and at 24 hr with paraquat. Both compounds concentrated in cartilaginous tissue and in the liver although diquat was selectively located in the gall bladder and paraquat was distributed throughout the liver parenchyma. Within 24 hr the excretion of diquat was virtually complete, and paraquat was eliminated from most tissues with small amounts present in lung and skeletal muscle. Neither paraquat nor diquat accumulated in tissues of rats during an 8-wk experiment in which they were fed diets containing 50, 120, and 250 ppm paraquat or 25 ppm diquat.

See also

73-2310	73-2335	73-2359	73-2376	73-2401	73-2425	73-2534
73-2320	73-2345	73-2369	73-2390	73-2409	73-2426	
73-2330	73-2352	73-2373	73-2391	73-2411	73-2529	

73-2515. Sztark, W.; Malissa, H.; Kellner, R. (Inst. Anorg. Chem. Technol., Techn. Hochschule, Krakow, Poland). **Direkte qualitative und quantitative infrarotspektroskopische Analyse von Zink-Dialkyldithiocarbamidaten ohne vorhergehende Auftrennung. [Direct qualitative and quantitative infrared spectroscopic analysis of zinc dialkyldithiocarbamates without prior separation.]** *Anal. Chim. Acta 63: 285-293; 1973.* (19 references)

A new method for the IR analysis of zinc-dialkyldithiocarbamate mixtures has been developed. The identification and detection limits were improved, compared to the standard method, by the use of microtechniques (detection limit 2 μg, identification limit 30-80 μg). Binary and ternary mixtures can be analyzed without preliminary separation because the other components of the mixtures have very little influence on the measured absorption band. Beer's law was obeyed for the binary and two ternary mixtures. The relative standard deviations and the coefficients of correlation were calculated for the macro and micro methods. A comparison of statistical data shows that IR spectroscopy is suitable for quantitative analysis even in the region of 80-10 μg of substance. (Author abstract by permission)

73-2516. Moll, F.; Koslovski, M. (Pharmazeut. Inst., Univ. Tubingen, Germany). **Kohlenstoff-Chlor-Valenzschwingungen und Konformation isomerer Hexachlorcyclohexane. 3. Mitt. ueber infrarotspektroskopische Untersuchung von Arzneistoffen. [Carbon-chlorine valence bonds and confirmation of isomeric hexachlorocyclohexanes. Part 3 of a series on infrared-spectroscopic study of drugs.]** *Arch. Pharm. 305(11): 829-833; 1972.* (13 references) (German)

Since the IR spectra of γ-BHC (lindane) and its α-, β-, and δ-isomers differ distinctly, the composition of mixtures can be determined qualitatively and quantitatively by infrared spectroscopy. However, the number of carbon-chlorine valence vibrations observed was unexpectedly high, which prevented direct band assignment according to the general principle that the higher-frequency bands correspond to the equatorial, and the lower frequency bands to the axial vibrations. Systematic correlations were established between the C-Cl vibration frequency and the nature of the two bonds adjacent to a given C-Cl bond to account for the effect of vibration coupling on the frequency. Five vibration types are possible (where a = axial and e = equatorial): eea, eee, eaa, eae, and aaa. The solvent-shift method was used to detect and confirm the vibration bands corresponding to these structures.

73-2517. Beyer, K. H.; Bothe, W. (Pharmaz. Inst., Freie Univ., Berlin, Germany). **Die quantitative Bestimmung des Morphamquat. [Quantitative determination of morfamquat.]** *Arch. Pharm. 306: 3-5; 1973.* (6 references) (German)

A spectrophotometric method is described for the quantitative determination of morfamquat in blood, urine, and feces. The morfamquat present in the sample, previously diluted with water, is isolated by means of Permutit RS 40, a strong acid ion exchange resin. The bis-pyridinium compound is then eluted at 96°C and pH 7.4-7.8 with ammonium chloride solution, saturated at room temperature. After reduction to a blue colored radical with sodium dithionite, the morfamquat present in the eluate is measured spectrophotometrically at 399 nm. The recovery rate from the ion exchange column is 95% for morfamquat concentrations of 10-1,000 μg.

73-2518. Watanabe, S.; Momo, H.; Kashiwa, T. (Agr. Chem. Insp. Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[Application of densitometry to simple determination of pesticides by thin-layer chromatography.]** *Bull. Agr. Chem. Insp. Sta. 12: 19-22; 1972.* (2 references) (Japanese)

A simple method of determining pesticides was proposed following TLC-densitometry. Eight pesticides were initially selected: fenthion, propoxur, chlordimeform, dichlone, anilazine, diuron, nitrofen, and propanil; the TLC conditions, such as concentration of solution, optimum amount for spotting, and the developing solvent combination were studied. TLC-densitometric procedures were further examined using technical products containing fenthion. Standards and specimens of fenthion were spotted on a TLC-plate and developed with 4:1 (v/v) benzene-acetone; then the chromatograms were examined by UV densitometry. Compared to the TLC-molybdovanadophosphoric acid method, the proposed method was not quite satisfactory because of its 4-5% variation range. By refining the experimental conditions, the proposed method was made applicable for the determination of fenthion, propoxur, and propanil in various formulations. It requires less than half as much time as the officially established procedure and appears to be applicable to the simultaneous determination of various pesticides.

73-2519. Kawahara, T. (Agr. Chem. Insp. Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[Studies on organochlorine pesticide residues in crops and soils. Report XIV. A method for removing the substances which interfere with analysis of residues in Welsh onion.]** *Bull. Agr. Chem. Insp. Sta. 12: 28-30; 1972.* (Japanese)

During residue analysis of heptachlor in the Welsh onion (*Allium fistulosum*), even after clean up of the onion extract by Florisil chromatography, some substances which are thought to be organosulfur compounds remain in the treated extract and interfere with gas chromatography using electron capture detection. A study was carried out on removal of the substances by alkaline hydrolysis and by washing the hydrolyzate with water. After Florisil clean up of the extract (corresponding to 50 g of onion) which had been partitioned

from acetone to *n*-hexane, 20 ml of 2% ethanolic potassium hydroxide was added to the dried extract and the mixture heated at 85°C for 5 min. The reaction mixture was transferred to a separating funnel with 30 ml of water and was extracted twice with 20 ml of *n*-hexane each time. The hexane layer was washed with 5% (v/v) aqueous ethanol, then with water; the hexane was dried, then concentrated under reduced pressure and injected onto a gas chromatograph with a glass column, 1.5 m long and 0.3 cm i.d., packed with 5% OV-17/Chromosorb W, acid-washed and silanized. Conditions were: column temp. 210°C, inlet temp. 250°C, and detector temp. 300°C, with N_2 carrier at 60 ml/min. From onion fortified by addition of 0.04 ppm of heptachlor the recovery was 97.5-100%, average 104.5%. The proposed method would be applicable to determining other organochlorine pesticide residues in crops like the Welsh onion.

73-2520. Watanabe, T.; Nakamura, H. (Agr. Chem. Insp. Sta., Min. Agr. and Forestry, Tokyo, Japan). **[Analytical method of several aryl *N*-methylcarbamate pesticide residues by oscillographic polarography.]** *Bull. Agr. Chem. Insp. Sta. 12: 57-62; 1972.* (5 references) (Japanese)

Optimal conditions for oscillopolarography were sought in a study of the adaptability of the method reported by Porter for carbaryl to the several aryl *N*-methyl carbamates. The method proposes nitrosation of the carbamate oxime group before applying polarography. The carbamates examined include carbaryl, Banol, propoxur, and 2-chlorophenyl-3-methylphenyl-, 2-isopropylphenyl-2-, 3,4-dimethylphenyl-, and 3,5-dimethylphenyl- *N*-methylcarbamate. Results of studies on detection and recovery of the carbamates from fortified apple samples showed that the proposed method was applicable for analyzing carbaryl, propoxur, and 3-methylphenyl-, 3,4-dimethylphenyl-, 2-ispropylphenyl-, and 3.5-dimethylphenyl esters in decreasing order of sensitivity. Detection sensitivity was not quite adequate, but was promising enough to apply to microanalysis. The method was not applicable to analysis of chlorine-containing carbamates such as 2-chlorophenyl *N*-methylcarbamate and Banol. In the proposed method, the procedures of condensing and drying must be performed carefully. Double peaks occasionally appear, depending on the procedural technique, but there is no difficulty in summarizing the amount corresponding to each peak. Since the dissolved carbamates tend to degrade, analysis should be conducted as rapidly as possible after dissolution of the specimen.

73-2521. Ishii, Y.; Yamashita, Y. (Agr. Chem. Inspect. Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[Studies on the microanalysis of N-methylcarbamate insecticides. Report III. Residue analysis of carbaryl.]** *Bull. Agr. Chem. Insp. Sta. 12: 63-70; 1972.* (16 references) (Japanese)

A gas chromatographic method was developed for determining carbaryl as 1-naphthyl-monochloroacetate. Vegetable samples were extracted with dichloromethane and the extracts cleaned up by the coagulation method. Extracts were washed with *N*/4 NaOH, then hydrolyzed to convert carbaryl to 1-naphthol. The hydrolysate was washed with benzene and monochloroacetylated with chloroacetic anhydride. Impurities were removed, and the test substance determined by GLC on a 2 m Chromosorb W column coated with 5% OV-210 or OV-17. The detection limit for pure standard was 10 pg. Recovery of carbaryl added to tomato, cucumber, lettuce, and unpolished rice at 0.05-0.2 ppm was between 70% and 96%. Polyamide thin-layer chromatography was suitable for qualitative detection of carbaryl residues with a detection limit of 100 ng.

73-2522. Baba, H. (Agr. Chem. Insp. Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[Analytical methods for streptomycin in plants. Part 1. Examination of analytical procedures.]** *Bull. Agr. Chem. Insp. Sta. 12: 76-81; 1972.* (12 references) (Japanese)

The cleanup and assay procedures were studied to improve the bioassay method for streptomycin residues in plants, applied for control of bacterial diseases. An aqueous streptomycin solution ranging from 0.025 to 0.5 m/ml was applied to a column packed with the Na form of a carboxylic acid type cation exchange resin. Then the column was washed and eluted with 200 ml of 0.3 *N* HCl. The eluate, adjusted to pH 6.0, was evaporated to dryness and dissolved in methanol. The solution was filtered to remove precipitated NaCl. The filtrate was evaporated, dissolved in .067 *M* phosphate buffer at pH 7.8, and assayed by the paper-disc method using *Bacillus subtilis* ATCC 6633 as the test organism. The disc method was suitable for residue assay because it demands less test solution than the conventional cup method. The discs saturated with test solution were placed on an agar plate and left standing for 14-15 hr at 5°C to diffuse before incubation. Use of the above-mentioned method improved the limit of sensitivity to 0.025 m/ml. *B. subtilis* was superior in sensitivity to *B. cereus* AM 1729. It was further found that the Na form of the cation exchange resin was better than the NH_4 form. When the resin was used long after conditioning, recoveries dropped. Cleanup with activated carbon was not effective because of low recovery. Fifteen μg of streptomycin in standard solution was 88% recovered, and contaminants in the clean-up procedures did not interfere with the assay.

73-2523. Baba, H. (Agr. Chem. Insp. Sta., Min. of Agr. and Forestry, Tokyo, Japan). **[Analytical method for streptomycin in plants. Part 2. Residues of streptomycin in tobacco.]** *Bull. Agr. Chem. Insp. Sta. 12: 82-85; 1972.* (3 references) (Japanese)

The analytical method for streptomycin residues was investigated using tobacco plants. Fresh tobacco

leaves were macerated, extracted with water at pH 2.0, and cleaned up as in the previous report (see abstract no. 73-2522.) However, the final solution in buffer (pH 7.8) was again filtered to remove vegetable sediments, thus removing a source of interference with the determination. The recovery rate for streptomycin added to tobacco leaves at 1 ppm was 97% with a detection limit of 0.01-0.02 ppm. An aqueous solution containing a commercial streptomycin formulation (125 ppm active ingredient) was sprayed on greenhouse tobacco seedlings. The leaves were collected immediately after or one, two, or three weeks after spraying, and the residual streptomycin in the leaves was determined by the method described. The residue level of 1-10 ppm on the day of application decreased to 0.1-0.8 ppm three weeks later.

73-2524. Agr. Chem. Insp. Sta. (Ministry of Agr. and Forestry, Tokyo, Japan). **[Information on determination of antibiotics registered for agricultural use.]** *Bull. Agr. Chem. Insp. Sta. 12: 115-121; 1972.* (21 references) (Japanese)

In Japan biological methods of determination have been established for four antibiotics often used as agricultural chemicals: blasticidin S, cycloheximide, kasugamycin, and streptomycin. Biological methods of determination have also been approved for six recently developed antibiotics registered as agricultural chemicals: ezomycin, novobiocin-sodium, polyoxin, polyoxin-D and its zinc salt, and oxytetracycline hydrochloride. Chemical methods have been officially established for cellocidin and oxytetracycline, and approved for griseofulvin. The present report tabulates the essential conditions for biological and chemical determination of these antibiotics and bibliographic references to the most commonly used methods. The items listed include the general procedure, the microorganisms used for examination and determination, the culture conditions, the sensitivity, the type of specimen, and the methods for extracting and purifying the pesticide to be tested.

73-2525. Soerensen, O. (Hygiene-Institut des Ruhrgebietes, Gelsenkirchen, Germany). **Gaschromatographischer Pestizidnachweis mit gekoppelten Detektoren. [Gas-chromatographic pesticide determination with coupled detectors.]** *GWF Wasser/Abwasser 114(5): 224-227; 1973.* (10 references) (German)

A universal gas-chromatograph with flame photometric detector and alkali flame ionization detector, each coupled with an electron capture detector, is described for determining organochlorine and organophosphorus pesticides. The sensitivity of all detectors is maintained at the original value by applying a flow seration ratio of 1:13 at the column outlet. The detection of phosphorus, nitrogen, sulfur, and halogens is thus possible through signal comparison. The specificity can be further increased by combined column and thin-layer chromatography. Application of the combined chromatographic procedure to the determination of organochlorine and organophosphorus pesticides in the Rhine water is described.

73-2526. Suffet, I.H. (Dept. of Chem., Environ. Studies Inst., Drexel Univ., Philadelphia, PA 19104). **The *p*-value approach to quantitative liquid-liquid extraction of pesticides and herbicides from water. III. Liquid-liquid extraction of phenoxy acid herbicides from water.** *J. Agr. Food Chem. 21(4): 591-598; 1973.* (25 references)

The goal of aqueous herbicide analysis is the recovery of 100% of an herbicide for qualitative and quantitative analysis. Liquid-liquid extraction is the method of choice for quantitative recovery from water. The *p*-value concept is useful in developing an understanding of the liquid-liquid extraction process in order to select optimum experimental conditions to approach 100% herbicide recovery. The best solvents for extraction of phenoxy acid herbicides are ethyl acetate and ether. The best solvents for simultaneous extraction of 2,4-D or 2,4,5-T and their *n*-butyl and isopropyl esters are ether and ethyl acetate (2,4-D and esters) and benzene (2,4,5-T and esters). Possible variation of the *p*-value caused by alteration of natural water characteristics was tested. The apparent *p*-values for 2,4-D obtained with waters from different sources and the *p*-value found in distilled water were found to be consistent. Adsorption characteristics of herbicide esters were changed upon adjustment of turbid water to the aqueous characteristics of the *p*-value method. Therefore, the aqueous sample should be filtered before adjustment of aqueous conditions for liquid-liquid extraction. The *p*-value gives a theoretical guide (an *Fn* value) for development of an aqueous residue procedure. Recovery data from the literature and a recovery study at high concentration confirmed the calculated *Fn* value. A two-step serial extraction with 200 and 50 ml of ethyl acetate under *p*-value conditions is the choice for extracting 99% of 2,4-D from 1 liter of aqueous solution. (Author abstract reprinted by permission of the American Chemical Society)

73-2527. Moye, H. A. (Food Sci. Dept., Univ. of Florida, Gainesville, FL 32601). **Reaction gas chromatographic analysis of pesticides. II. On-column transesterification of organophosphates by methanol.** *J. Agr. Food Chem. 21(4): 621-625; 1973.* (11 references)

A method is described for the on-column transesterification of four classes of organophosphate pesticides to the corresponding methyl esters, chromatography on Porapak P or Q, and detection by Rb_2SO_4 pellet alkali flame ionization detector. Reproducible conversions were obtained for transesterification with methanol. Distinguishing gas chromatographic peaks were also obtained when the organophosphates were

injected in ethanol, 1-propanol, and 1-butanol. Chromatographic and detector conditions are given for the simultaneous analysis of a carbamate (Mobam) with the four classes of organophosphate pesticides. (Author abstract reprinted by permission of the American Chemical Society)

73-2528. Shafik, T.; Bradway, D. E.; Enos, H. F.; Yobs, A. R. (Perrine Primate Lab., Environ. Protect. Agency, Perrine, FL 33157). **Human exposure to organophosphorus pesticides. A modified procedure for the gas-liquid chromatographic analysis of alkyl phosphate metabolites in urine.** *J. Agr. Food Chem. 21(4): 625-629; 1973.* (7 references)

A previously described method for analysis of alkyl phosphates (Shafik and Enos, 1969) has undergone a major modification. The new method is more suitable for use in a monitoring program designed to determine human exposure to organophosphate pesticides. Improvements in the methodology include preparation of a less volatile ester derivative of the alkyl phosphate and selection of gas chromatographic columns and conditions which are more compatible with systems used in a routine chlorinated hydrocarbon pesticide residue program. The average recovery of the six dialkyl phosphates from human urine fortified at the 0.1 ppm level was 98.3%. The amyl derivatives of the dialkyl phosphates showed a remarkable increase in sensitivity compared to the methyl and ethyl derivatives on two gas chromatographic columns normally used in pesticide residue analysis. Data illustrating the application of the new method to a human monitoring program are presented. (Author abstract reprinted by permission of the American Chemical Society)

73-2529. Feung, C.; Hamilton, R. H.; Mumma, R. O.* (Dept. of Entomol. and Biol., Pestic. Res. Lab. and Grad. Study Cent., Pennsylvania State Univ., University Park, PA 16802). **Metabolism of 2,4-dichlorophenoxyacetic acid. IV. Mass spectra and chromatographic properties of amino acid conjugates.** *J. Agr. Food Chem. 21(4): 632-637; 1973.* (14 references)

Twenty L-form amino acid conjugates of 2,4-dichlorophenoxyacetic acid (2,4-D) were prepared and characterized by mass spectrometry, paper and thin-layer chromatography. Nineteen of the conjugates produced molecular ions and all gave characteristic spectra. The fragmentations of high *m/e* are few in number, usually intense, predictable, and charaterized by the chlorine isotope peaks. Collectively these data have aided in the identification of several metabolities of 2,4-D and will be useful in identifying other similar metabolites of 2,4-D, as well as other acidic plant growth regulators. These studies suggest that 2,4-dichlorophenoxyacetyl derivatives of peptides may be desirable for mass spectral investigations similar to the commonly used long-chain fatty acyl derivatives. (Author abstract reprinted by permission of the American Chemical Society)

73-2530. Young, H. Y.; Chu, A. (Univ. of Hawaii, Honolulu, HI 96822). **Microdetermination of chloro-*s*-triazines in soil by gas-liquid chromatography with nickel electron capture or electrolytic conductivity detection.** *J. Agr. Food Chem. 21(4): 711-713; 1973.* (7 references)

The Cl-*s*-triazines, simazine, atrazine, and propazine, are extracted from soil with a mixture of ethyl acetate and methanol and determined by gas-liquid chromatography with nickel electron capture or electrolytic conductivity detection. Cleanup is necessary for the former but not the latter detector. Sensitivity is placed at 1 ng in the injected sample and the least determinable concentration at 0.1 ppm of soil. Recovery of added triazine ranged from 84 to 112%. (Author abstract reprinted by permission of the American Chemical Society)

73-2531. Villanueva, E. C.; Burse, V. W.; Jennings, R. W. (Bio-Effects Branch, Environ. Protect. Agency, Chamblee, GA 30341). **Chlorodibenzo-*p*-dioxin contamination of two commercially available pentachlorophenols.** *J. Agr. Food Chem. 21(4): 739-740; 1973.* (10 references)

A comparison was made of chlorodibenzo-*p*-dioxin contamination in a technical and an analytical grade of commercially available pentachlorophenols. Hexa-, hepta-, and octachlorodibenzo-*p*-dioxin were found in both samples. The technical product was more contaminated than the analytical one by factors of 1400, 1600, and 539 for the hexa-, hepta-, and octachlorodibenzo-*p*-dioxin, respectively. Tetrachlorodibenzo-*p*-dioxin was not found. Results were determined by gas chromatography and confirmed by infrared spectrophotometry and mass spectrometry. Mass spectral analysis indicated the presence of polychlorodibenzofurans and polychlorodiphenyl ethers. A distinction was made, using gas chromatography-mass spectrometry, between the chlorodibenzofurans observed as original constituents of the pentachlorophenol and those derived from the fragmentation of chlorodiphenyl ethers. (Author abstract reprinted by permission of the American Chemical Society)

73-2532. Launer, J. E. (Lab. Serv., Oregon Dept. of Agr., Salem, OR 97310). **Collaborative study of a gravimetric method for mercury in formulations containing chlorinated pesticides.** *J. Ass. Offic. Anal. Chem. 56(3): 572-575; 1973.* (6 references)

A gravimetric method for mercury was modified and collaboratively studied with formulations containing ~6% phenylmercuric urea and ~7% captan in one test pair and ~2% phenylmercuric urea and 30% lindane in

another test pair. Mercury is determined by precipitation and weighing cupric propylene mercury iodide, following refluxing with dilute HI-H_2SO_4 solution containing I_2. Single determinations on 4 samples by 11 collaborators showed that the standard deviation estimation of random error was 0.063 for the captan pair and 0.034 for the lindane pair. Standard deviation estimates of systematic error were 0.061 and 0.013, respectively. In the preliminary study, the method showed close agreement with other accepted methods for 15 formulations. Lindane, captan, dieldrin, heptachlor, and zineb do not interfere; however, the method is not applicable to chloro- or nitrophenolic compounds nor to materials not decomposed by the digestion mixture. The method has been adopted as official first action. (Author abstract by permission)

73-2533. Hammond, H. (State Lab. Dept., Bismarck, ND 58501). **Free acid in esters of 2,4-dichlorophenoxyacetic acid and 2,4,5-trichlorophenoxyacetic acid and their formulations.** *J. Ass. Offic. Anal. Chem. 56(3): 596-597; 1973.*

The free acid content of 2,4-D and 2,4,5-T esters and formulations is determined by titration to pH 7.0, using a pH meter. Average recoveries and standard deviations for 9 collaborators, analyzing 4 samples containing different amounts of the esters, were 0.2067±0.0201 and 0.3778±0.0245 for 2,4-D ester and 0.6208±0.0555 and 1.4622±0.1356 for 2,4,5-T ester. The method has been adopted as official first action. (Author abstract by permission)

73-2534. Kumar, P.; Sud, R. K.; Gupta, K. G. (Dept. of Microbiol., Panjab Univ., Chandigarh-14, India). **Interference of some pesticides in the milk phosphatase pasteurization test.** *J. Dairy Sci. 56(5): 553-557; 1973.* (11 references)

Some pesticides in milk interfere with the phosphatase test. Baygon (propoxur) and Sevin (carbaryl) formed a blue color witu phenol reagent in milk. 1-Naphthol, a degradation product of Sevin, had the same effect in pasteurized milk. Dimethylcarbamates decreased phenol formation in raw milk, but in pasteurized and in under-pasteurized milk a true phosphatase test was obtained. Tetramethyl thiuram disulfide (thiram) at 25 μg/.5 ml and at higher concentrations influenced the test of under-pasteurized milk. Phosphamidon and dichlorvos at 5 μg/.5 ml gave phenol values in under-pasteurized milk equivalent to that in raw milk. Twelve pesticides decreased phenol formation in raw milk. (Author abstract by permission)

73-2535. Gafford, R. D. (Beckman Instruments, Inc., Fullerton, CA 92634). **Automation of monitoring equipment for marine pollution studies.** *IN: Marine Pollution and Sea Life, Fishing News (Books) Ltd., London, 1972, pp. 491-500.* (32 references)

Organochlorine pesticides are analyzed by many procedures, including thin layer and gas-liquid chromatography, and sensitivity of the results varies from 0.001 to 1.0 μg/l. depending on the compound. Although gas chromatography has been automated, automation of the carbon absorption method is unlikely due to difficulties in the one-time extraction phase. The liquid-liquid extraction process is semi-automated with good prospects for full automation in the future. A method which appears compatible with complete automation involves burning a 0.03 to 1.000 μg sample of the pesticide in a small automatic combustion chamber and quantitatively trapping the evolved gas in a continuously flowing aqueous medium. The chloride ion concentration of the solution is measured by a standard silver-silver chloride electrode. It may be possible to conduct six separate evaluations during one hour. Organophosphorus compounds are analyzed by gas chromatography and hydrogen flame emission photometry, which has undergone significant improvement of late, to suppress the effects of sulfur emission in the flame, thus increasing the sensitivity and the usefulness of the method for detecting airborne pesticides. Phenols can be detected by paper or column chromatography, colorimetry, and an automated method based on oxidative coupling with 3-methyl 2-benzothiazolinone hydrazone.

73-2536. Taylor, I. S. (Commonwealth Lab., Melbourne, Australia). **Organic environmental residues.** *Proc. Roy. Aust. Chem. Inst. 39(12): 350-354; 1972.*

Pesticides, particularly organochlorines, have been the center of attention in work on organic residues in the environment. Separation of these residues from the vast quantity of substrate, which may have similar properties, is commonly accomplished partially using liquid extraction followed by column chromatography. Liquid permeation chromatography is also being investigated, but all these techniques require a determinative step having a high degree of specificity. GLC is the most frequently used determinative method, and the detector is normally electron capture for chlorinated hydrocarbons and alkaline flame for organophosphates. FAO and WHO are slowly establishing allowable daily intakes for pesticides although it is difficult to compare the needs of tropical or underdeveloped countries with those of cooler climates or more economic stability. Generally even very stable pesticides reach a plateau in soil, plants, or animals during application; the level decays when application ceases, but there are exceptions to this pattern. Except in some localized situations, atmospheric residues of pesticides are still well below the level which could result in significant concentrations in the diet or in the body. Polychlorinated biphenyls, less toxic but more permanent than DDT, interfere with the analysis of organochlorines, and there are 102 probable combinations.

73-2537. Mukherjee, G.; Mathew, T. V. (Cent. Food Lab., Calcutta 16, India). **A rapid clean-up procedure for the isolation of chlorinated pesticides in milk, fats, and oils.** *Res. Ind. 17(3): 101-102; 1972.* (9 references)

A direct silica gel adsorption procedure was substituted successfully for the column chromatography separation of fat from organochlorine pesticide residue samples. The sample, dissolved in petroleum ether, was macerated with 10 g of silica gel until the ether was evaporated off, and a paste of the silica gel and water was extracted with acetonitrile. The pesticides were removed from the acetonitrile with petroleum ether, concentrated, and determined by TLC. The procedure was rapid and simple and gave approximately 100% recovery.

73-2538. Belfiore, M. P.; Kesten, E. M.; Nunez, C. G.; Gomez Artero, J. G. (Inst. Nac. Technol. Indust., Inst. Nac. Farmacol. Bromatol., Buenos Aires, Argentina). **Comparacion de dos metodos de aislamento y purificacion en la determinacion de pesticidas organochlorados. [Comparison of two methods for isolation and clean-up in the determination of organochlorine pesticides].** *Rev. Asoc. Bioquim. Argent. 37(201-202): 114-122; 1972.* (9 references) (Spanish)

Methods of preparing samples containing organochlorine pesticides for gas chromatographic analysis are compared for effectiveness in detecting pesticide residues in excess of Argentine meat and milk industry tolerances. With the Mills method and others used by the Instituto de Racionalizacion de Materiales, the lipid sample, dissovled in a nonpolar solvent such as *n*-hexane or petroleum ether, is extracted with another polar solvent which selectively dissolved the organochlorine. Acetonitrile, dimethylformamide, and dimethylsulfoxide (DMSO) are used; DMSO is preferred because it permits excellent recovery. The use of DMSO is impeded by the fact that emulsions forming in the liquid-liquid separation are difficult to break. The Wood cleanup system uses a small column in which the stationary phase is the mixed sample on a Celite support and DMSO is the mobile phase. The DMSO containing the pesticides is chromatographed on a column containing a layer of Florisil and a layer of alumina as the packing and *n*-hexane as the eluant. The DMSO-containing sector of the tube produces liquid-liquid partitioning chromatography in which the *n*-hexane extracts the organochlorines, glycerides, and other interfering substances. In the portion of the tube without DMSO, absorption chromatography results in the fact that the Florisil retains the glycerides and other interfering substances while the pesticides appear in the eluate. The Wood method gave excellent recovery and reproducibility at a low cost and in a short time.

See also 73-2351 73-2386 73-2388 73-2509

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